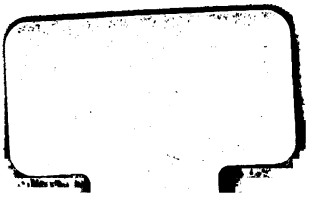


University of Cincinnati.

PUBLICATIONS

OF THE

Cincinnati Observatory.

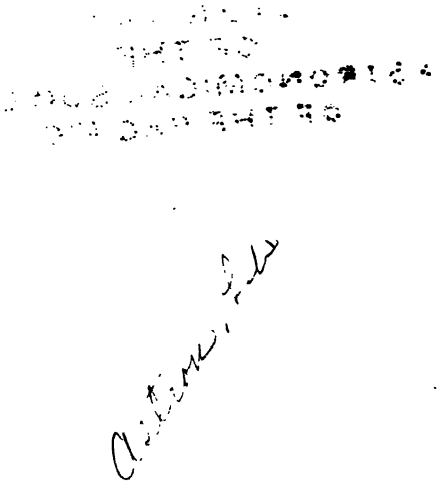
—6—

Micrometrical Measurements

OF

DOUBLE STARS,

1879-80.



PUBLICATIONS OF THE CINCINNATI OBSERVATORY.

—6—

MICROMETRICAL MEASUREMENTS

OF

455 DOUBLE STARS,

OBSERVED WITH THE

11 INCH REFRACTOR

DURING THE YEAR ENDING SEPTEMBER 1, 1880,

UNDER THE DIRECTION OF

ORMOND STONE, A. M.,

ASTRONOMER.

CINCINNATI:
PUBLISHED BY AUTHORITY OF THE BOARD OF DIRECTORS OF THE UNIVERSITY.
1882.

INTRODUCTION.

THE present number of the Publications of this observatory consists partly of the results of observations preliminary to the preparation of a general catalogue of known double stars, situated between the equator and 30° south declination, and partly of observations of double stars which Mr. Burnham has found, in the course of his investigations, to need re-observing. These latter stars are not limited to the southern hemisphere. Northern stars were usually observed but once, except in cases where the first observation differed to such an extent from that given by Mr. Burnham as to indicate a possibility of change, either in position angle or distance. Southern objects, which had not already been measured at this observatory, were observed, as far as possible, twice. Binaries were, of course, observed more frequently. The observers were Messrs. H. A. Howe, H. V. Egbert and myself.

Personal Equation.—The observations were made and reduced in substantially the same manner as those contained in No. 5. The personal equations of Mr. Howe and myself were assumed to be the same as hitherto. Mr. Egbert's observations were included with the others, but reduced to the common standard by means of the following corrections deduced from observations contained in this number:

Class of Obs.	Corr. P.	No. of Comp.	Corr. D.	No. of Comp.
E_n	$0^\circ.0-0^\circ.6\,w$	38	$-0''.01$	22
E_p	$-1.7-0.6\,w$	45	$+0.12$	28

where P is the position angle, D the distance and w the reciprocal of the visual angle (Publications Cincinnati Observatory, No. 5, Introduction).

A comparison of the mean results contained in this and the previous number gave for position angles:

$$C_6-C_5=-0^\circ.2+0^\circ.6\cos 2P+0^\circ.3\sin 4P-[1^\circ.0+1^\circ.1\sin(2P-60^\circ)]\,w,$$

and for distances,

$$C_6-C_5=+0''.12+0''.08\sin(2P-60^\circ)-0.015\,D.$$

Binaries.—Those stars of the Dorpat Catalogue which show a difference of more than 3° between C_6 and Σ may be classified as follows:

Differences between 3° and 5°: Σ 30, 82, 103, 105, 114, 233, 280, 355, 444, 487, 516, 529, 536, 564, 1146, 1506, 1690.

Differences between 5° and 10°: Σ 67, 118, 122, 248, 334, 371, 407, 442, 493, 609, 712, 1847, 2023, 3081.

Differences between 10° and 20°: Σ 23, 86, 113, 295, 408, 1500, 1876.

Differences greater than 20°: Σ 125, 308?, 483?, 651?, 1216, 1664, 1670, 1998.

The following have differences in distance greater than 1″.0: Σ 23, 30, 125, 171, 308?, 476, 518AB, 651?

A similar comparison with the micrometrical measures made by Sir John Herschel with his seven-feet equatorial, at the Cape of Good Hope, gave the following classification:

Difference between 5° and 10°: h 5232.

Difference between 10° and 20°: h 2036.

Difference greater than 20°: Sh 243.

A comparison with observations made with the twenty-feet reflector gave:

Differences between 5° and 10°: h 3068, 4337, 4478, 4839, 5393, 5394.

Differences between 10° and 20°: h 4637, 4826.

The following doubles discovered by Mr. Burnham also need further attention: β 4, 267, 437, 555, 584.

ORMOND STONE,

Astronomer of the Cincinnati Observatory.

Mt. Lookout, February, 1882.

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
1	Σ 3063	0 1	31 40	33 45	175 30	40.748	40.215	—0.2	n	A
2	...	...	35 50	37 50	175 30	...	...	—0.3	p	A
3	...	...	39 20	41 25	175 44	40.290	39.768	—0.2	n	A
4	Σ 3064 rej.	0 2	169 55	170 15	175 44	43.508	36.552	—3.6	p	III
5	β 486	0 8	359 30	2 35	355 34	40.978	40.037	—0.8	n	A
6	...	...	2 40	2 35	355 38	40.953	40.049	—1.0	n	III
7	Σ 15	0 10	193 30	193 25	355 42	40.164	38.657	—1.7	p	A
8	h 1947	0 10	72 25	73 15	355 44	41.256	38.628	—3.2	n	III
9	Weisse	0 11	282 35	283 0	175 44	40.752	39.198	—3.5	n	A
10	Σ 23	0 11	164 30	165 30	175 42	40 678	38.300	0.0	n	A
11	β 393	0 12	6 20	7 10	355 42	40.593	40.366	—0.3	p	VI
12	β 256	0 13	245 10	245 20	355 30	40.848	40.142	—0.7	p	A
13	H v 85	0 14	12 0	12 0	355 44	49.188	30.788	—3.1	p	III
14	...	...	192 45	192 50	175 30	48.658	35.333	—2.6	p	III
15	Σ 30	0 21	294 35	295 5	355 44	43.323	37.696	—5.2	n	A
16	...	...	295 15	295 25	355 44	42.883	37.253	—3.0	n	III
17	Σ 31	0 22	234 35	235 30	175 44	40.803	39.208	—2.8	n	III
18	...	...	221 25	221 35	175 44	40.814	39.192	—2.8	p	III
19	h 1968	0 22	246 50	247 50	175 30	41.568	39.360	—0.7	p	A
20	...	...	245 15	248 10	175 30	41.587	39.422	—0.8	p	A
21	h 1980	0 25	299 20	301 5	175 30	40.353	38.656	—0.8	p	III
22	h 3377	0 27	233 30	234 10	175 30	42.198	37.834	—1.5	p	III
23	h 3379	0 31	227 30	227 10	355 42	42.753	38.254	0.0	n	A
24	...	...	225 40	226 30	355 42	42.602	38.372	0.0	p	A
25	...	...	226 0	227 25	355 30	42.503	38.473	—0.6	p	A
26	h 1044	0 34	315 25	315 30	355 44	43 272	36.874	—2.7	n	III
27	...	...	314 35	315 5	355 44	43.210	36.815	—2.6	p	III
28	Σ 67	0 46	3 10	4 45	355 42	40.240	39.738	—1.9	n	III
29	...	...	181 35	183 30	175 42	39.782	39.214	—1.8	p	III
30	h 2000	0 46	291 10	291 35	175 30	42.092	36.947	0.0	p	III

Number.	Position Angle.		Distance.		Magnitudes.		Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.					
	°	°	″	″					
1	217.2	217.7	1.82	1.74	...		79.771	S	
2	221.3	221.8	...	...	8.5	9.5	79.771	S	
3	224.6	222.3	1.78	1.83	8.0	9.0	79.582	H	Very faint on account of twilight.
4	354.4	353.9	23.74	23.78	7.0	10.0	79.612	H	
5	5.5	5.7	3.21	3.13	6.0	11.0	79.765	S	Color of principal star 3.15.
6	7.0	7.3	3.09	2.93	5.5	10.0	79.760	S	Color of principal star 5.18.
7	197.8	196.0	5.14	5.26	9.0	10.5	79.658	E	Distance very poor.
8	77.1	76.4	8.97	9.07	7.0	9.0	79.612	H	
9	107.1	106.4	5.30	5.35	8.0	8.2	79.612	H	
10	349.3	349.2	8.12	8 11	...		79.746	E	
11	11.0	11.4	0.77	0.77.	6.0	8.0	79.749	S	Distance est. 0″.5. Beautifully divided.
12	249.8	250.3	2.41	2.41	8.5	9.5	79.773	S	Both stars white.
13	16.3	16.0	62.79	62.83	7.5	9.0	79.612	H	
14	17.3	15.6	62.54	62.78	...		79.784	E	Micrometer II changed 5 rev. in reduction.
15	299.1	299.1	19.20	19.12	7.0	9.0	79.604	S	Cloudy.
16	299.6	299.0	19.21	19.31	6.5	8.0	79.612	H	
17	59.3	58.5	5.44	5.54	...		79.612	H	
18	55.8	55.7	5.54	5.58	8.5	9.0	79.612	H	Position Angle changed 10° in reduction.
19	71.8	72.2	7.54	7.54	7.0	11.0	79.787	S	
20	71.2	71.6	7.39	7.39	7.0	10.5	79.853	S	Poor measure.
21	124.7	122.8	5.79	6.03	...		79.776	E	
22	58.3	56.5	18.31	18.55	...		79.902	E	Poor definition; companion very faint.
23	231.6	231.9	15.35	15.27	...		79.749	S	
24	230.4	230.6	14.44	14.44	7.5	10.0	79.749	S	
25	231.2	231.4	13.75	13.75	6.5	9.0	79.773	S	Clouds; distance poor.
26	319.7	319.1	21.84	21.94	8.5	8.7	79.612	H	
27	319.1	318.6	21.82	21.86	...		79.612	H	
28	8.3	4.1	1.71	1.81	8.0	9.0	79.735	H	Moderately good night.
29	6.8	4.6	1.94	2.18	9.0	10.0	79.658	E	Blurry and faint.
30	115.9	114.2	17.56	17.80	...		79.902	E	

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
31	β 734	0 47	340 25	342 30	355 42	42.097	38.924	—0.6	n	A
32	Σ 70	0 47	58 55	59 15	175 30	40.717	38.305	—2.6	n	A
33	...	...	240 50	240 20	355 30	40.673	38.314	—2.8	n	A
34	W. C. 457, 8	0 47	6 50	9 45	355 42	41.292	39.658	—0.3	n	A
35	H. A. H. 1	0 50	279 20	280 45	175 30	40.747	40.247	—0.4	p	A
36	...	...	278 45	280 50	175 30	40.738	40.230	—0.8	p	A
37	Σ 76	0 50	196 35	197 20	355 42	39.954	39.035	—1.7	p	III
38	Σ 82	0 54	123 25	121 30	175 42	39.791	39.085	—1.8	n	III
39	h 2010	0 56	267 5	267 35	355 44	41.442	38.532	—2.8	n	III
40	h 1064	0 56	358 50	0 10	355 44	...	...	—2.6	p	III
41	Σ 86	0 59	334 50	337 5	175 30	...	...	—0.7	p	A
42	...	...	334 55	336 10	175 30	...	...	—0.8	p	I
43	...	...	155 55	155 45	355 42	41.398	38.622	—0.5	n	A
44	...	...	334 25	335 10	175 30	41.387	37.594	—1.1	n	A
45	...	...	165 15	165 0	355 30	41.385	37.646	—1.3	n	A
46	h 10 A,B	0 59	310 20	311 30	355 42	40.672	39.308	—1.5	n	III
47	...	...	306 40	307 25	355 42	...	...	—1.4	p	III
48	...	...	308 40	309 40	355 42	...	...	...	...	...
49	... A,C	...	230 40	232 55	175 42	41.273	38.705	—1.4	p	III
50	...	...	232 35	232 15	175 42	...	...	—1.8	p	A
51	... B,C	...	258 10	258 40	355 42	31.562	38.412	—1.4	p	III
52	...	...	260 45	261 10	355 42	...	...	—1.7	p	A
53	H iv 66	1 0	250 25	251 0	175 30	42.865	36.173	—2.4	n	A
54	Σ 89 rej.	1 0	190 20	190 40	175 42	41.869	37.137	—1.2	n	A
55	h 633	1 3	139 5	139 20	355 42	40.886	38.132	—1.8	n	III
56	Σ 96	1 5	96 55	97 15	175 30	39.687	39.308	—2.4	p	A
57	Σ 101	1 8	336 0	337 10	355 30	43.568	47.394	—0.6	n	A
58	...	...	335 30	336 30	335 34	43.586	37.428	—1.1	n	III
59	H. V. E. A,B	1 9	89 10	88 50	175 30	...	...	—2.2	n	III
60	... A,C	...	110 5	109 50	335 30	...	...	—2.2	p	III

Number.	Position Angle.		Distance.		Magnitudes.	Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.				
	°	°	″	″				
31	345.8	345.6	10.83	10.75	5.5 9.5	79.694	S	
32	243.6	243.5	8.23	8.22	...	79.779	E	
33	245.1	245.0	8.05	8.04	...	79.784	E	Poor definition.
34	12.6	12.7	5.58	5.50	7.0 9.0	79.694	S	
35	104.5	105.2	1.71	1.71	8.5 8.5	79.773	S	Both stars white.
36	104.3	105.0	1.73	1.73	8.5 8.5	79.787	S	
37	201.3	199.3	3.14	3 38	9.0 13.0	79.735	E	
38	306.8	306.8	2.41	2.40	8.0 9.0	79.658	E	
39	271.6	270.8	9.93	10.03	8.0 9.5	79.612	H	Poor definition.
40	3.8	3.4	15.e	...	6.0 13.0	79.612	H	Tangent screw not used. Too faint for distance.
41	160.5	161.0	...	...	...	79.853	S	
42	160.0	...	...	...	...	79.853	S	
43	160.1	160.1	12.89	12.88	...	79.746	E	Mic. II assumed 37.622 in reduction.
44	159.3	159.3	12.94	12.93	...	79.776	E	
45	169.6	159.6	12.76	12.75	...	79.902	E	Pos. Angle changed 10° in reduction.
46	315.2	314.0	4.66	4.76	8.5 10.0	79.656	H	
47	311.3	311.5	...	...	...	79.656	H	
48	313.5	313.4	...	...	... 9.5	79.656	E	
49	56.1	55.7	8.76	8.80	...	79.656	H	
50	56.7	54.9	...	...	8.0 9.0	79.656	E	
51	262.7	262.5	10.75	10.79	... 10.0	79.656	H	
52	265.3	263.5	...	...	...	79.656	E	
53	75.2	75.2	22.84	22.83	...	79.779	E	
54	14.8	14.8	16.15	16.14	8.5 9.0	79.752	E	
55	143.5	143.4	9.40	9.39	10.0 11.0	79.735	E	
56	281.6	279.5	1.29	1.41	...	79.779	E	
57	341.1	340.9	21.07	20.99	7.0 10.0	79.787	S	Mic. II assumed 37.394 in reduction.
58	340.4	340.2	21.02	20.86	7.0 9.5	79.765	S	
59	273.5	271.8	...	...	...	79.779	E	Near a double having Pos. Angle = 190°.
60	114.5	114.5	...	...	...	79.779	E	

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
61	Σ 103	1 9	240 55	241 15	355 42	40.231	38.700	—1.7	p	III
62	Σ 106	1 10	123 15	124 30	175 42	40.178	38.824	—1.5	n	III
63	Σ 102 A,B	1 11	309 0	306 25	355 44	...	...	—2.4	n	A
64	...	...	307 50	309 35	355 44	...	...	—2.3	p	A
65	... ½(A+B),C	...	221 5	220 55	355 44	41.430	38.504	—2.7	n	A
66	...	...	220 35	220 10	355 44	41.460	38.500	—2.6	p	A
67	... ½(A+B ,D	...	239 0	239 15	175 44	44.039	35.829	—2 3	n	A
68	Σ 105	1 11	179 50	179 40	355 30	39.910	39.094	—2.0	p	A
69	Σ 112	1 14	144 35	144 15	175 30	42.791	36.180	2.9	p	III
70	Σ 113	1 14	344 5	344 40	355 34	40.683	40.284	—0.9	n	VI
71	...	...	340 40	343 35	335 30	40.706	40.264	—0.2	n	VI
72	h 2036	1 14	197 15	201 40	175 30	40.728	40.245	—0.6	n	VI
73	...	...	201 15	203 0	175 30	...	...	—0.6	p	A
74	...	...	202 10	201 30	175 30	39.690	39.282	—1.2	p	A
75	...	...	199 25	200 2	175 30	39.725	39.212	—1.0	p	A
76	...	...	201 50	200 30	175 42	...	...	—0.5	p	A
77	Σ 114	1 15	168 30	168 45	175 42	40.064	38.938	—1.2	n	A
78	...	...	169 20	170 30	175 30	...	...	—1.8	...	...
79	β 4	1 17	287 45	300 30	175 42	...	...	—1.3	p	A
80	Secchi	1 18	251 30	252 25	175 30	40.882	40.114	—0.1	p	A
81	Σ 120	1 19	94 40	94 40	175 42	41.100	38.938	+0.2	p	III
82	...	...	276 40	276 30	355 30	40.610	38.407	—1.2	p	III
83	Σ 122	1 21	324 30	326 0	355 42	40 850	39.178	—1.9	n	III
84	...	...	322 50	321 50	355 42	40.463	38.572	—2.0	n	III
85	Σ 118	1 21	67 20	67 5	355 30	41.193	37.797	—1.7	p	A
86	...	...	67 20	66 30	355 42	41.173	37.832	—1.3	p	III
87	Σ 125	1 21	166 25	167 0	175 42	44.508	35.392	—0.1	n	III
88	Σ 127	1 25	181 45	182 5	355 42	43.123	35.859	—2.2	n	A
89	...	...	1 40	0 55	175 42	43.082	35.901	—1.3	n	III
90	h 1085	1 30	112 50	114 15	175 42	40.059	38.928	—2.1	p	A

Number.	Position Angle.		Distance.		Magnitudes.		Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.					
	°	°	″	″					
61	245.4	243.6	5.23	5.47	8.0	11.0	79.735	E	Very faint.
62	308.2	307.9	4.62	4.61	9.0	9.0	79.735	E	
63	312.0	304.8	0.5e	0.52	7.0	8.0	79.612	H	
64	313.0	310.8	...	...	...		79.612	H	
65	225.3	224.9	9.99	10.04	7.0	8.5	79.612	H	
66	224.6	224.5	10.10	10.12	...		79.612	H	
67	63.4	63.0	28.02	28.07	7.0	10.0	79.612	H	Two other faint doubles in the field.
68	184.2	182.3	2.78	2.90	...		79.779	E	Blurry.
69	328.9	327.2	22.56	22.80	...		79.784	E	
70	348.8	348.9	1.36	1.32	7.5	8.0	79.765	S	Pretty steady, but thick haze.
71	346.6	346.6	1.51	1.47	5.5	7.5	79.787	S	
72	24.0	24.2	1.65	1.61	...		79.771	S	
73	26.6	26.8	...	...	7.5	8.0	79.771	S	
74	26.3	24.1	1.39	1.51	...		79.776	E	Blurry.
75	24.2	22.1	1.75	1.87	...		79.902	E	Very blurry.
76	25.5	23.4	...	...	...		79.746	E	
77	352.9	352.7	3.84	3.83	...		79.752	E	
78	354.4	354.2	...	...	...		79.779	E	
79	118.4	119.1	0.5e	0.52	7.0	7.0	79.656	H	Wide companion at 100°.
80	76.0	76.5	2.62	2.62	7.0	9.0	79.771	S	
81	279.0	278.6	7.38	7.42	7.0	11.0	79.680	H	
82	281.1	279.2	7.52	7.51	...		79.776	E	
83	329.6	328.4	5.71	5.81	7.5	9.0	79.658	H	
84	326.6	326.4	6.45	6.44	8.0	9.0	79.658	E	
85	71.7	70.0	11.59	11.71	...		79.779	E	
86	71.2	69.4	11.40	11.64	8.5	9.5	79.754	E	
87	351.0	350.6	31.11	31.21	8.0	10.0	79.680	H	
88	186.2	186.2	24.79	24.78	8.0	9.0	79.754	E	
89	185.6	185.6	24.51	24.50	8.5	9.5	79.754	E	
90	297.8	295.9	3.86	3.98	8.5	9.0	79.754	E	

Number.	Double Star.	Mean R.A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
91	h 1085 (*continued.*)	1 30	113 25	113 50	355 42	40.046	38.951	—1.5	p	A
92	h 17	1 33	276 30	276 50	355 42	41.156	38.873	—1.5	p	A
93	h 641	1 34	304 30	306 30	175 30	40.313	68.646	...	n	A
94	...	...	304 55	304 35	175 42	40.291	38.703	—1.6	...	...
95	Σ 146	1 35	301 35	301 35	355 42	...	...	—1.4	n	A
96	...	...	301 40	301 25	355 42	43.529	36.487	—1.4	p	A
97	Σ 147	1 36	262 25	263 0	175 42	40.512	39.492	0.0	p	III
98	...	...	265 25	265 25	175 42	40.042	38.957	—0.6	p	A
99	Σ 160	1 40	85 0	86 10	175 42	41.398	38.638	—2.0	p	III
100	...	...	266 15	266 30	355 30	40.903	39.082	—1.0	p	III
101	Σ 166	1 42	357 40	357 0	355 42	41.119	38.885	—1.9	n	III
102	...	...	175 50	176 0	175 30	40.709	38.284	—0.8	n	III
103	β	1 42	343 20	349 0	355 30	...	...	—0.2	n	A
104	...	...	169 40	169 25	175 42	...	...	—0.3	n	A
105	...	...	165 0	163 10	175 42	...	...	—0.6	n	A
106	H. V. E.	1 42	143 15	143 45	355 30	40.341	38.696	—2.8	p	A
107	h 644	1 42	93 5	93 40	175 42	42.484	37.506	—1.2	p	III
108	Σ 171	1 43	335 0	335 55	175 42	44.340	35.595	—1.8	n	III
109	...	...	335 10	335 10	355 30	43.892	35.092	—0.6	n	III
110	Σ 173 rej.	1 44	20 0	19 55	175 42	43.298	36.712	—1.1	n	III
111	...	...	199 10	199 40	355 42	43.286	36.738	—1.0	p	III
112	Σ 170	1 44	240 40	241 35	355 42	39.985	39.024	—1.4	n	A
113	...	...	241 30	241 50	255 42	40.001	39.020	—1.3	p	A
114	Σ 177	1 45	297 35	297 55	175 42	44.449	34.398	—1.2	p	III
115	Σ 3113	1 46	270 15	270 20	355 44	40.143	39.808	—2.7	n	A
116	β 183	1 47	219 15	223 45	355 30	40.830	40.122	—0.2	p	A
117	Σ 199	1 56	15 40	16 5	355 30	44.819	34.187	—1.7	n	A
118	Σ 206	1 56	309 35	309 50	175 42	44.551	35,387	—1.1	n	III
119	Σ 214	2 1	7 55	8 25	175 42	40.710	39.277	—1.9	n	III
120	...	...	4 15	4 5	175 42	40.719	39,285	—1.9	...	...

Number.	Position Angle.		Distance.		Magnitudes.	Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.				
	°	°	″	″				
91	298.1	296.2	3.74	3.86	...	79.779	E	
92	281.0	280.8	7.79	7.81	9.0 10.0	79.656	H	
93	130.0	129.9	5.69	5.68	...	79.776	E	Difficult to measure with Power A.
94	129.0	128.8	5.42	5.41	8.5 11.0	79.735	E	
95	305.9	305.5	...	...	...	79.656	H	
96	305.8	305.7	24.03	24.05	8.0 8.0	79.656	H	
97	87.0	86.4	3.48	3.52	6.0 7.0	79.680	H	
98	89.7	87.8	3.70	3.82	...	79.746	E	
99	269.8	269.6	9.42	9.46	9.0 10.0	79.658	H	
100	270.9	269.1	9.63	9.87	...	79.776	E	
101	1.6	0.5	7.62	7.72	8.5 9.0	79.658	H	
102	0.4	0.3	8.28	8.27	...	79.776	E	
103	350.7	350.9	1.4e	1.42	8.0 9.0	79.787	S	Poor definition.
104	353.8	351.8	...	...	8.5 10.0	79.680	H	Distance impossible.
105	348.6	348.2	...	...	...	79.902	E	Too faint for distance.
106	148.0	146.2	5.61	5.73	8.0 8.5	79.784	E	
107	277.7	277.5	16.99	17.03	7.5 13.0	79.656	H	
108	159.8	159.3	29.84	29.94	8.5 8.5	79.658	H	
109	339.7	339.7	30.03	30.02	...	79.776	E	
110	204.3	203.7	22.48	22.58	8.5 10.0	79.656	H	
111	203.7	203.2	22.35	22.39	...	79.656	H	
112	245.4	245.2	3.28	3.27	7.0 8.5	79.754	E	
113	246.0	244.1	3.35	3.47	...	79.754	E	
114	122.0	120.3	34.30	34.54	9.0 9.5	79.735	E	Careful measure.
115	274.6	272.2	1.14	1.19	8.5 8.5	79.612	H	
116	226.3	226.7	2.42	2.42	8.0 9.5	79.771	S	Clouds; principal star white.
117	20.4	20.4	36.28	36.27	...	79.779	E	
118	134.0	133.6	31.28	31.38	8.0 9.0	79.656	H	
119	192.5	190.8	4.89	4.99	8.0 9.5	79.658	H	
120	188.5	187.7	4.90	4.94	...	79.658	H	Assumed p III.

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
121	Σ 222	2 4	211 30	211 15	175 30	41.967	37.039	—2.9	p	A
122	Σ 231	2 7	47 5	47 5	175 42	42.311	37.670	—0.4	n	III
123	...	...	45 40	45 50	175 42	42.272	37.652	—0.3	p	III
124	Σ 237	2 9	53 35	53 30	175 42	41.113	38.889	—1.2	p	III
125	...	...	232 0	231 55	355 42	41.046	38.008	—1.0	p	I
126	Σ 233	2 10	91 15	91 10	175 42	...	...	—1.4	p	III
127	...	...	92 10	91 25	175 30	...	...	—1.2	...	...
128	Σ 238	2 10	172 5	171 55	175 30	41.094	37.894	—2.6	p	III
129	Σ 246	2 11	297 0	298 15	175 30	41.032	38.968	—2.2	...	...
130	Σ 247 rej.	2 12	28 50	29 50	355 42	...	...	—1.9	n	III
131	...	...	27 55	29 5	355 42	41.051	38.904	—1.8	p	III
132	β 437	2 12	25 15	26 50	355 42	40.818	39.128	—1.8	p	III
133	Σ 248	2 14	330 40	332 15	175 44	40.322	39.763	—2.9	p	A
134	Σ 250	2 14	312 45	312 25	175 44	40.374	39.588	—2.5	n	A
135	Σ 251	2 14	260 20	263 35	355 44	40.273	39.630	—2.8	n	A
136	Σ 261	2 18	243 30	242 55	175 42	40.420	39.558	—0.9	p	A
137	...	...	243 40	243 55	175 42	40.432	39.557	—1.1	p	III
138	Σ 271	2 24	177 0	177 10	355 30	41.256	37.720	—1.7	...	...
139	Σ 276	2 26	250 20	250 20	255 42	40.306	39.692	—1.8	p	III
140	Σ 280	2 28	343 45	343 10	355 42	40.502	39.480	—0.2	n	A
141	...	...	164 0	164 5	175 42	40.492	39.513	—0.4	n	III
142	...	...	342 10	342 30	355 42	40.037	39.987	—1.4	n	III
143	...	...	340 45	342 0	355 42	39.961	39.959	—1.2	n	I
144	h 3506	2 29	236 30	239 0	355 30	42.064	38.943	—0.8	p	A
145	...	...	236 15	237 20	355 30	42.113	38.851	—0.5	p	I
146	Σ 282	2 31	107 10	107 55	175 30	40.552	38.473	—1.5	n	A
147	...	...	110 5	110 10	175 30	40.559	38.433	—1.5	p	A
148	Σ 287	2 32	247 35	247 20	175 42	40.938	39.054	—1.0	p	A
149	h 1123	2 34	63 20	63 35	175 44	42.978	37.043	—2.6	n	A
150	...	...	63 10	62 55	175 44	42.912	37.026	—2.7	p	A

Number.	Position Angle.		Distance.		Magnitudes.	Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.				
	°	°	″	″				
121	35.9	34.2	16.82	16.94	...	79.785	E	
122	231.4	230.6	15.84	15.94	6.0 8.0	79.680	H	
123	230.0	229.5	15.77	15.81	...	79.680	H	Windy.
124	237.8	237.4	14.42	14.46	8.0 8.3	79.656	H	Distance changed 2 rev. in reduction.
125	236.3	...	13.78	...	...	79.656	H	Distance changed 1 rev. in reduction.
126	275.5	273.3	...	...	...	79.754	E	Clouded up.
127	276.3	274.4	...	...	...	79.779	E	Too faint for distance.
128	356.5	354.7	10.92	11.16	...	79.785	E	
129	122.1	122.1	10.46	10.45	...	79.785	E	Distance changed 1 rev. in reduction.
130	33.6	32.2	...	...	10.0 10.5	79.658	H	
131	32.8	32.2	7.33	7.37	...	79.658	H	
132	30.3	29.6	5.77	5.81	8.0 12.0	79.658	H	Very faint.
133	155.7	155.1	1.91	1.93	8.5 9.0	79.612	H	
134	136.8	135.4	2.68	2.73	8.0 9.0	79.612	H	
135	266.2	265.2	2.19	2.24	8.0 9.0	79.612	H	
136	67.5	67.1	2.94	2.96	...	79.656	H	
137	68.1	67.5	2.99	3.03	8.5 9.0	79.656	H	
138	181.6	181.6	12.07	12.06	...	79.785	E	
139	254.6	254.3	2.10	2.14	8.5 8.5	79.658	H	
140	347.8	346.9	3.49	3.54	...	79.680	H	
141	348.3	346.7	3.34	3.44	8.0 8.0	79.680	H	
142	346.6	346.3	3.58	3.57	...	79.735	E	
143	345.7	...	3.42	...	...	79.735	E	Mic. II assumed 38.959 in reduction.
144	242.2	242.4	10.65	10.65	4.5 7.5	79.787	S	Both stars white.
145	241.3	...	11.13	...	...	79.787	S	
146	292.0	291.9	7.10	7.09	...	79.779	E	
147	294.6	292.8	7.26	7.38	...	79.779	E	
148	71.8	71.5	6.30	6.32	7.5 10.0	79.656	H	
149	247.7	247.3	20.26	20.31	...	79.612	H	
150	247.3	247.2	20.09	20.11	8.0 8.2	79.612	H	Micrometer reversed.

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
151	0 Σ 44	2 34	45 40	48 25	355 44	40.231	39.779	—2.8	p	A
152	0 Σ 45	2 35	292 15	291 40	355 42	39.777	39.218	—0.8	p	A
153	h 2155	2 35	136 25	137 55	175 44	42.512	37.528	—2.4	n	III
154	...	...	316 40	316 20	355 44	42.568	37.518	—2.1	p	III
155	Σ 295	2 35	320 35	321 20	355 42	...	...	—0.3	n	A
156	...	...	318 25	317 50	355 42	40.662	39.372	—0.2	p	A
157	...	...	138 45	137 50	175 30	40.133	38.824	—1.2	n	A
158	Σ 299	2 37	283 50	285 50	355 42	39.950	39.050	—1.2	p	A
159	Σ 303	2 39	358 25	356 35	175 42	40.768	39.242	—1.9	n	III
160	...	...	176 30	176 0	355 30	40.321	38.675	—1.1	n	A
161	Br. 394	2 39	182 35	182 45	355 30	41.218	36.784	—0.7	n	III
162	Σ 308	2 42	333 50	333 30	175 30	41.322	37.695	—0.9	n	III
163	β 10	2 44	97 10	95 20	175 42	40.348	39.610	—0.2	p	III
164	Σ 330	2 51	8 35	8 15	175 42	40.218	39.740	—1.6	n	A
165	...	...	188 5	187 55	355 30	40.788	38.218	—0.8	p	III
166	Σ 334	2 53	311 15	312 15	355 30	...	...	—1.2	...	...
167	Σ 341	2 57	44 55	44 35	175 42	...	...	—0.3	n	III
168	...	...	45 20	45 15	175 42	...	...	0.0	n	I
169	...	...	42 0	43 50	175 42	41.238	38.732	—2.1	p	III
170	...	...	43 10	43 5	175 42	41.208	39.745	—0.2	p	III
171	...	...	41 5	42 40	175 42	41.152	38.787	+0.1	p	I
172	...	...	225 10	224 20	355 42	40.752	38.261	—1.8	p	III
173	Σ 355	3 1	322 10	323 5	175 42	40.360	39.631	—1.4	n	A
174	Σ 358	3 3	346 0	348 35	355 42	...	...	—2.1	n	III
175	h 3554	3 7	343 35	344 10	355 42	42.927	37.083	—1.2	n	III
176	β 84	3 10	203 55	207 25	175 30	40.610	40.382	—0.2	n	VI
177	Σ 371 A,C	3 10	259 40	259 35	175 44	40.400	39.593	—2.7	n	III
178	Jacob	3 14	277 30	277 15	355 30	...	...	...	p	III
179	Schj. 1001	3 19	359 35	359 55	175 42	42.478	37.469	—1.2	n	III
180	Σ 393	3 20	74 25	73 55	175 42	42.360	37.658	—1.1	p	III

Number.	Position Angle.		Distance.		Magnitudes.	Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.				
	°	°	″	″				
151	51.3	51.2	1.54	1.56	8.0 9 0	79.612	H	In a cluster.
152	296.3	294.3	1.91	2.03	6.5 10.0	79.735	E	
153	321.4	320.7	17.01	17.11	8.0 9.5	79.612	H	
154	320.8	320.3	17.23	17.27	...	79.612	H	
155	325.3	324.6	...	...	6.0 11.0	79.680	H	
156	322.4	322.4	4.40	4.42	...	79.680	H	
157	322.8	322.7	4.47	4.46	...	79.902	E	Very poor definition.
158	289.1	287.2	3.07	3.19	4.0 10.0	79.735	E	
159	181.8	180.3	5.21	5.31	8.0 9.0	79.658	H	
160	180.8	180.7	5.62	5.61	...	79.776	E	
161	187.2	187.1	11.72	11.71	...	79.902	E	Mic. assumed 37.784 in reduction.
162	158.2	158.1	12.38	12.37	...	79.776	E	
163	100.6	100.1	2.52	2.56	8.0 12.0	79.680	H	Clouds.
164	192.8	192.1	8.46	8.51	7.5 9.5	79.656	H	Dis. changed 2 rev. in reduction.
165	192.5	190.7	8.77	9.01	...	79.776	E	
166	316.2	315.8	...	...	...	79.902	E	Too poor definition for distance.
167	229.0	227.8	...	...	8.0 9.5	79.680	H	
168	229.6	...	...	...	...	79.680	H	
169	227.2	226.6	8.55	8.59	8.0 10.0	79.658	H	
170	227.4	226.8	8.41	8.45	...	79.680	H	Error of 1 rev. in distance.
171	226.2	...	8.07	...	...	79.680	H	
172	229.0	227.2	8.50	8.74	8.0 12.0	79.732	E	Very faint, poor definition.
173	146.9	145.7	2.49	2.54	8.5 9.0	79.656	H	
174	351.6	350.8	10.e	...	9.0 12.0	79.658	H	
175	348.2	347.6	19.94	20.04	8.0 11.0	79.656	H	
176	30.2	30.6	0.78	0.74	6.0 8.0	79.783	S	
177	83.9	82.0	2.75	2.85	8.0 10.0	79.612	H	B: 10m, P = 180°, D = 1″.
178	281.9	280.0	...	...	...	79.902	E	
179	184.0	183.4	17.10	17.20	8.0 9.0	79.656	H	1m prec., 5′± south of Σ 393.
180	258.5	258.2	16.05	16.09	8.0 10.5	79.656	H	

Number.	Double Star.	Mean R.A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
181	Σ 394	3 21	339 50	339 20	175 42	40.986	39.026	—2.3	n	III
182	H iv 89	3 24	322 45	324 15	175 42	42.988	37.040	—2.2	n	III
183	Σ 407	3 24	223 15	221 25	175 42	39.858	39.008	—1.2	p	III
184	Σ 408	3 25	332 50	333 55	355 30	39.692	39.307	+0.2	n	A
185	Σ 414	3 28	0 15	1 15	175 42	41.119	38.918	—2.1	n	III
186	...	...	357 40	358 45	175 42	41.033	38.922	—2.1	p	III
187	Σ 416 rej.	3 28	48 50	48 50	355 42	43.783	36.209	—2.0	p	III
188	Σ 438	3 36	235 35	237 0	355 42	40.257	39.742	—2.0	p	III
189	Σ 439	3 37	33 10	33 30	355 44	43.417	36.578	—2.8	p	III
190	Σ 442	3 38	258 35	261 50	355 42	...	...	—1.9	p	III
191	H. A. H.	3 38	313 55	313 0	175 42	44.112	35.857	—1.8	n	III
192	Σ 444	3 39	332 40	333 40	355 42	40.386	39.596	—1.6	n	III
193	Σ 451 rej.	3 40	137 40	136 50	175 42	42.452	36.572	—1.3	n	III
194	Σ 456 rej.	3 42	294 40	294 50	175 42	43.170	36.794	—1.3	p	III
195	β 401	3 44	251 15	251 45	355 30	40.082	38.908	0.0	n	III
196	...	...	253 20	253 25	355 30	...	...	—1.5	p	III
197	Σ 468	3 48	273 35	272 25	175 42	42.978	37.042	—1.2	p	III
198	Σ 478	3 53	311 35	312 30	175 42	40.971	38.091	—1.3	n	III
199	Σ 476	3 54	281 45	280 50	355 44	42.882	37.020	—0.9	n	III
200	Σ 487 A,B	3 55	183 55	184 45	175 42	41.288	37.672	—1.1	n	III
201	... A,C	...	231 45	230 30	355 42	...	...	—1.1	p	III
202	Σ 482	3 56	300 0	299 15	175 42	41.910	38.070	—1.7	n	III
203	Σ 483	3 56	348 0	350 55	175 44	40.304	39.722	—2.8	p	III
204	Σ 493	4 0	269 15	269 40	175 42	40.238	39.749	—1.2	p	A
205	...	...	266 40	268 40	175 42	40.237	39.774	—1.3	p	III
206	Σ 515	4 7	39 35	39 40	355 42	...	...	—1.2	n	A
207	...	...	38 35	39 35	355 42	40.458	39.531	—1.2	p	A
208	Σ 512	4 7	221 0	222 0	355 44	40.720	39.200	—2.7	n	A
209	...	...	220 25	221 35	355 44	40.705	39.267	—2.4	n	III
210	...	...	218 50	219 45	355 44	40.752	39.263	—2.8	p	A

Number.	Position Angle.		Distance.		Magnitudes.		Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.					
	°	°	″	″					
181	163.9	162.7	6.69	6.79	7.0	8.0	79.658	H	
182	147.8	147.3	20.30	20.40	8.0	9.5	79.658	H	
183	46.6	44.5	2.90	3.14	8.0	10.0	79.735	E	Very faint.
184	337.9	337.4	1.31	1.30	...		79.787	E	Very blurry.
185	185.0	183.7	7.51	7.61	7.5	7.5	79.658	H	
186	182.5	181.8	7.20	7.24	...		79.658	H	
187	53.0	52.7	25.85	25.89	8.5	9.5	79.658	H	
188	240.6	240.3	1.76	1.80	8.0	8.8	79.658	H	
189	37.6	37.3	23.34	23.38	8.0	10.0	79.612	H	
190	264.5	263.1	2.e	...	9.0	10.0	79.658	H	
191	137.8	137.3	28.17	28.27	8.0	12.0	79.658	H	Principal star suspected double; P = 330°, D = 0″5.
192	337.5	335.1	2.70	2.80	7.5	10.5	79.658	H	
193	321.6	321.5	20.07	20.06	8.0	8.5	79.735	E	
194	119.0	118.9	21.76	21.80	8.5	9.5	79.656	H	
195	256.0	255.7	4.01	4.00	6.0	10.0	79.771	E	Windy.
196	257.9	255.9	...	...	...		79.776	E	Too faint for distance.
197	97.3	97.1	20.76	20.80	8.5	9.5	79.656	H	
198	136.3	136.2	9.83	9.82	8.0	9.0	79.735	E	
199	285.6	285.0	20.01	20.11	7.5	8.5	79.612	H	
200	8.6	8.5	12.34	12.33	...		79.735	E	
201	235.4	233.6	...	...	...		79.735	E	
202	123.9	123.3	13.10	13.20	8.0	9.5	79.658	H	
203	173.7	172.6	1.99	2.03	8.0	9.5	79.612	H	Star unsteady.
204	93.8	93.6	1.67	1.69	...		79.656	H	
205	92.0	91.8	1.58	1.62	8.0	8.5	79.656	H	
206	43.9	42.4	...	...	8.0	8.5	79.656	H	
207	43.4	42.8	3.16	3.18	...		79.656	H	
208	225.8	225.3	5.19	5.24	...		79.612	H	
209	225.3	224.5	4.91	5.01	...		79.612	H	
210	223.6	223.4	5.08	5.10	7.5	7.5	79.612	H	

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
211	Σ 512 (*continued.*)	4 7	219 15	219 55	355 44	40.722	39.185	—2.3	p	III
212	Σ 516	4 9	325 5	325 35	175 42	40.384	38.586	—2.4	n	III
213	Σ 518 A,B	4 10	280 50	280 45	175 42	52.562	28.412	—0.7	p	III
214	...	...	280 55	280 40	175 42	47.495	38.454	—0.8	p	II
215	... A,D	...	308 6	309 27	175 30	45.808	35.239	—0.5	n	III
216	...	...	...	...	...	45.610	35.115	0.0	n	III
217	... B,C	...	295 5	295 0	175 42	40.965	40.001	—0.2	p	III
218	Σ 525 rej. A,B	4 13	239 35	239 40	355 42	46.440	33.546	—1.0	p	III
219	... B,C	...	344 25	345 40	175 42	41.046	38.940	—1.1	n	III
220	Σ 527	4 13	5 25	8 35	175 30	41.354	39.602	—0.2	n	A
221	Σ 529	4 15	192 45	191 30	175 42	40.154	38.824	—2.8	p	A
222	Σ 536	4 16	154 45	154 50	355 30	39.763	39.242	—0.1	n	A
223	O. S.	4 24	342 25	342 20	355 30	40.504	38.518	—1.6	n	A
224	Σ 562	4 28	88 45	87 5	175 42	...	...	—2.0	n	III
225	...	...	81 0	81 5	175 42	40.304	39.672	—2.1	p	III
226	Σ 564	4 28	338 25	339 0	355 30	40.041	38.969	—0.4	n	A
227	β	4 28	40 10	41 50	355 30	...	...	—0.6	n	III
228	...	...	42 0	46 20	355 30	...	...	—0.5	p	III
229	Σ 609	4 44	251 35	251 15	175 30	39.848	39.139	—0.4	p	A
230	Σ 607	4 46	64 40	66 10	175 42	42.072	37.908	—2.2	p	III
231	0 Σ 91	4 50	232 30	233 20	355 42	40.600	40.386	—0.4	p	VI
232	β 314	4 54	322 0	332 15	355 30	...	...	—0.5	n	VI
233	Σ 651	5 4	231 15	231 30	175 30	41.982	36.987	—0.7	p	A
234	Σ 661	5 8	357 5	356 30	355 42	40.358	39.634	—1.5	n	A
235	β 555 A,B	5 9	330 35	337 15	175 42	...	..	—0.7	n	VI
236	Σ 668 $\frac{1}{2}$(A+B),C	...	196 45	197 20	355 42	41.890	39.087	—0.4	n	VI
237	...	...	197 40	197 25	355 42	41.410	38.580	—1.8	n	III
238	...	...	19 20	18 40	175 42	41.391	38.644	—1.3	n	III
239	...	...	194 45	198 20	355 42	41.405	38.628	—1.8	p	III
240	...	...	16 20	17 40	175 42	41.329	38.638	—1.3	p	III

Number.	Position Angle.		Distance.		Magnitudes.	Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.				
	°	°	″	″				
211	223.8	223.7	5.25	5.29	...	79.612	H	
212	149.6	149.4	6.14	6.13	6.0 10.0	79.732	E	Definition very bad.
213	105.2	105.6	82.42	82.42	4.0 8.5	79.763	S	
214	105.1	...	82.05	...	... 9.0	79.752	S	Distance changed 5 rev. in reduction. Color of principal star 5.18.
215	133.3	132.9	36.07	35.91	... 13.5	79.783	S	
216	...	...	35.82	35.66	... 12.0	79.763	S	Another comp. at about the same distance from A at 180°±
217	119.3	120.0	3.29	3.29	... 10.5	79.752	S	
218	243.9	243.6	44.01	44.05	8.0 9.0	79.656	H	
219	169.3	168.3	7.19	7.29	9.0 9.5	79.656	H	
220	191.5	190.7	5.98	5.90	7.5 10.0	79.785	S	
221	16.4	14.6	4.54	4.66	8.0 10.0	79.746	E	
222	159.3	159.0	1.78	1.77	...	79.771	E	
223	346.9	346.8	6.78	6.77	...	79.902	E	
224	272.2	270.6	...	...	...	79.658	H	
225	265.3	265.4	2.16	2.20	7.5 11.0	79.658	H	
226	343.2	343.0	3.66	3.65	...	79.787	E	Faint and difficult.
227	45.5	46.5	...	...	6.0 9.0	79.783	S	
228	48.7	49.6	...	...	...	79.783	S	Driving clock stopped.
229	75.9	74.0	2.42	2.54	...	79.771	E	
230	249.7	249.5	14.21	14.25	9.0 11.0	79.658	H	
231	237.2	237.7	0.73	0.73	8.0 8.5	79.752	S	
232	331.6	331.9	...	...	...	79.785	S	Very poor definition.
233	55.9	54.2	17.05	17.17	...	79.787	E	
234	1.1	359.6	2.47	2.52	...	79.656	H	
235	158.3	158.7	0.4e	0.42	1.0 6.0	79.763	S	Pear-shaped; no illumination; magnificent definition.
236	201.4	201.5	9.57	9.53	... 6.5	79.763	S	
237	201.8	200.7	9.66	9.76	1.0 7.0	79.656	H	
238	203.3	202.2	9.38	9.48	...	79.658	H	Just before sunrise.
239	200.8	200.2	9.48	9.52	...	79.656	H	
240	201.3	200.6	9.18	9.22	...	79.658	H	5 m. before sunrise.

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
241	Σ668½(A+B)C (*continued.*)	5 9	196 30	196 40	355 42	40.934	38.118	—2.0	p	A
242	...	...	196 0	197 0	355 42	40.832	38.174	—1.8	p	I
243	Σ 667	5 9	309 0	309 10	175 42	40.079	38.953	—0.6	p	III
244	h 3752	5 15	274 45	274 50	175 30	40.932	40.042	—0.6	p	VI
245	Σ 701	5 18	219 50	219 55	175 42	40.332	38.644	—0.4	n	III
246	Σ 702	5 18	254 30	253 10	175 42	40.767	38.270	—1.5	p	III
247	Σ 706	5 19	217 45	216 45	175 42	40.022	38.937	—3.5	p	A
248	H vi 68	5 19	276 55	276 50	355 30	...	...	—1.5	p	III
249	Σ 712	5 20	230 15	230 45	175 30	39.908	39.062	—1.4	p	A
250	...	...	231 45	231 30	175 42	39.926	39.068	—1.7	p	...
251	β 320	5 23	281 15	283 35	355 30	...	...	—0.2	p	VI
252	...	...	280 5	280 35	355 42	40.870	40.116	—0.4	p	A
253	...	...	278 30	283 35	335 30	...	...	—0.3	p	III
254	Σ 743	5 29	275 15	276 30	355 30	39.783	39.171	—0.6	p	A
255	Σ 741	5 29	281 5	281 20	355 30	40.939	38.015	—0.7	p	III
256	H. V. E.	5 29	240 10	240 5	355 30	46.322	33.646	—1.2	p	III
257	Σ 748 A,B	5 29	55 0	55 20	355 42	41.895	38.090	—2.1	p	III
258	... A,C	...	307 20	308 15	355 42	41.858	38.119	—2.0	n	III
259	... B,D	...	295 5	295 5	355 42	42.768	37.187	—2.2	n	III
260	... C,c	...	342 0	343 40	355 42	40.506	39.500	—2.4	n	III
261	...	...	166 10	166 15	175 30	...	...	—0.3	n	A
262	...	...	166 0	167 0	175 42	...	...	—1.3	n	III
263	... C,D	...	28 0	27 25	355 42	41.218	38.772	—2.3	p	III
264	Σ 752 A,B	5 30	318 25	318 45	175 42	41.609	38.350	—1.8	n	III
265	H. C. Zones	5 30	217 30	216 30	175 30	...	...	—0.9	p	III
266	Σ 754	5 31	284 15	283 30	355 42	40.264	38.752	—0.4	p	III
267	Σ 755	5 32	311 25	314 5	355 42	40.833	39.148	—2.8	n	III
268	Σ 759	5 32	318 40	319 30	355 42	44.365	35.577	—2.5	n	III
269	Σ 763	5 33	314 40	316 0	355 42	40.817	39.190	—2.6	n	III
270	Σ 774	5 35	328 0	328 20	175 30	40.885	40.110	—0.4	n	A

Number.	Position Angle.		Distance.		Magnitudes.		Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.					
	°	°	″	″					
241	200.9	199.1	9.61	9.73	...		79.735	E	
242	200.8	...	9.07	...	...		79.735	E	
243	313.4	311.4	3.84	4.08	7.0	10.0	79.735	E	
244	99.3	99.7	3.04	3.04	4.5	7.0	79.784	S	Distance observed without illumination.
245	44.2	144.0	5.76	5.75	...		79.735	E	Pos. Angle changed 100° in reduction.
246	78.1	76.3	8.52	8.76	8.0	9.0	79.735	E	Very faint.
247	41.6	39.7	3.70	3.82	8.0	10.0	79.746	E	Windy.
248	281.4	279.7	...	...	...		79.825	E	Distance 9 rev. ±
249	55.0	53.1	2.89	3.01	...		79.825	E	
250	55.9	54.0	2.93	3.05	...		79.735	E	
251	286.9	287.4	...	...	3.0	8.0	79.783	S	Definition too poor for distance.
252	284.6	285.2	2.57	2.57	2.5	7.5	79.752	S	Color of principal star 5.20.
253	285.5	286.3	...	...	...		79.783	S	
254	280.4	278.4	2.09	2.21	...		79.771	E	Distance poor; very blurry.
255	285.7	283 9	9.98	10.22	...		79.787	E	Companion very faint.
256	244.6	242.9	43.26	43.50	...		79.825	E	Observed for Σ 744.
257	59.5	59.1	12.98	13.02	5.5	7.0	79.658	H	Upper side of trapezium.
258	312.1	311.5	12.76	12.86	...	7.0	79.658	H	Dis. observed with bright field.
259	299.4	298.9	19.05	19.15	...	8.0	79.658	H	Right hand side of trapezium.
260	347.1	345.2	3.43	3.53	...	11.0	79.658	H	
261	350.7	350.5	...	...	...		79.771	E	
262	350.8	350.5	...	...	...		79.735	E	
263	32.0	31.4	8.31	8.35	...		79.658	H	Lower side of trapezium.
264	142.9	142.2	11.12	11.22	...		79.658	H	
265	41.5	39.7	...	...	...		79.825	E	Too faint for distance.
266	288.2	286.3	5.16	5.40	...		79.735	E	
267	317.0	315.7	5.75	5.85	8.5	9.0	79.658	H	
268	323.4	322.9	29.99	30.09	8.0	8.5	79.658	H	
269	319.8	318.6	5.55	5.65	8.0	9.0	79.658	H	
270	152.7	152.6	2.64	2.56	4.0	5.0	79.784	S	Distance observed without illumination.

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
271	Σ 774 (*continued.*)	...	325 5	330 35	175 30	...	...	−0.5	n	I
272	...	...	330 5	331 0	175 42	40.368	39.615	−2.0	n	III
273	Σ 790	5 40	265 45	267 0	175 30	40 543	38.440	−0.8	p	III
274	Σ 839	5 59	278 50	280 10	355 30	41.206	39.764	−0.4	p	A
275	...	...	283 55	284 5	355 42	40.229	38.751	−0.8	p	III
276	Σ 871	6 5	300 5	300 50	355 42	40.588	38.424	−0.9	n	A
277	H iv 81	6 31	258 10	258 25	355 30	42.034	36.951	−0.9	p	A
278	A. G. C. 1	6 40	41 55	42 25	355 42	...	...	−1.0	n	A
279	...	...	41 30	41 55	355 42	41.996	38.982	−1.1	p	A
280	Σ 1011	6 55	295 30	294 30	335 42	40.136	38.831	−1.4	p	III
281	h 750	7 0	269 30	268 0	175 30	40.729	38.270	−1.4	p	III
282	h 2362	7 2	184 35	184 10	355 30	43.674	35.319	−2.0	p	A
283	Σ 1034	7 4	192 20	190 50	175 30	39.903	39.108	−1.2	n	III
284	Σ 1045	7 7	225 15	226 0	355 30	40.357	38.688	−1.1	p	A
285	h 3938	7 9	246 10	246 5	355 30	42.391	36.568	−1.0	p	III
286	Σ 1056	7 10	115 50	116 5	175 30	...	...	−1.9	n	A
287	Σ 1103	7 24	240 50	239 50	355 30	40.125	38.860	−1.1	p	A
288	β 201	7 34	324 0	327 8	355 30	40 917	40 076	−0.4	n	A
289	Σ 1124	7 34	140 5	140 25	175 30	42.427	37.710	−1.5	n	III
290	Σ 1146	7 42	189 35	190 5	175 30	39.921	38.989	−0.8	n	A
291	...	...	191 10	191 50	175 30	39.913	39.006	−0.9	p	A
292	0 Σ 182	7 46	212 30	212 5	175 30	39.684	39.312	−1.2	p	A
293	β 334	8 2	349 45	350 5	355 30	...	...	−0.1	n	A
294	H. A. H. 9	8 12	287 0	290 5	355 30	40.962	40.006	−0.2	p	A
295	Σ 1216	8 15	337 10	345 30	175 30	...	...	+0.1	n	A
296	Σ 1260	8 35	297 5	297 10	355 30	40.218	38.766	−0.1	p	P
297	β 587	8 46	326 10	327 30	175 30	...	...	−0.1	n	A
298	Σ 1295	8 50	353 0	354 5	355 30	40.102	39.864	+0.1	n	A
299	β 210	8 51	358 15	359 30	178 13	40.890	40.140	−0.3	n	A
300	...	...	359 40	359 15	178 13	40.905	40.123	−0.4	n	A

Number.	Position Angle.		Distance.		Magnitudes.		Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.					
	°	°	″	″					
271	152.3	...	...	...	3.5	5.5	79.784	S	
272	154.8	152.6	2.57	2.67	...		79.658	H	Dark wires.
273	90.9	89.0	7.18	7.42	...		79.787	E	
274	284.0	284.5	4.92	4.92	8.0	8.2	79.784	S	
275	288.3	286.4	5.04	5.28	...		79.735	E	
276	305.0	304.9	7.39	7.38	...		79.787	E	
277	262.8	261.1	17.35	17.47	...		79.787	E	Definition poor.
278	46.5	46.8	...	...	...		79.752	S	No illumination.
279	46.0	46.2	10.29	10.29	1.0	7.0	79.752	S	No illumination.
280	299.3	297.3	4.45	4.69	9.0	9.5	79.735	E	
281	93.2	91.4	8.39	8.63	...		79.771	E	
282	188.9	187.2	28.51	28.63	...		79.825	E	
283	16.1	15.6	2.71	2.70	...		79.771	E	
284	230.1	228.3	5.70	5.82	...		79.787	E	Definition poor.
285	250.6	248.8	19.87	20.11	...		79.771	E	
286	300.5	300.3	...	...	...		79.825	E	Too blurry for distance.
287	244.8	243.0	4.32	4.44	...		79.771	E	
288	330.1	330.8	2.87	2.79	7.0	8.0	80.155	S	Very windy.
289	324.8	324.7	19.50	19.49	...		79.815	E	Poor definition; Mic. II assumed 36.710 in reduction.
290	14.3	14.1	3.18	3.17	...		79.771	E	
291	16.0	14.1	3.10	3.22	...		79.771	E	
292	36.8	34.7	1.27	1.39	...		79.771	E	
293	354.4	354.2	...	...	...		80.177	E	
294	293.0	293.6	3.26	3.26	8.5	9.0	80.223	S	
295	165.8	166.4	0.6e	0.62	...		80.223	S	Clearly separated.
296	301.6	...	4.96	...	...		80.218	E	
297	151.3	152.2	0.4e	0.42	5.0	8.0	80.223	S	Perhaps only atmospheric elongation.
298	358.0	357.9	4.22	4.14	7.0	7.5	80.229	S	Mic. II assumed 38.864 in reduction.
299	180.6	180.7	2.56	2.48	7.0	7.0	79.237	S	
300	181.2	181.3	2.67	2.59	6.0	6.0	79.261	S	Both stars white.

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
301	Σ 1308	8 59	261 0	261 30	175 30	41.044	37.948	—0.1	p	P
302	h 4172	9 1	30 55	33 35	175 30	41.527	39.445	—0.1	n	A
303	...	...	31 35	34 15	175 30	...	...	0.0	...	...
304	W. M. C. Z.	9 25	53 15	53 30	175 30	...	...	+0.1	n	A
305	β 217	10 1	274 30	274 40	355 30	39.780	39.200	—0.5	p	A
306	...	...	275 45	275 15	355 30	39.782	39.212	—0.8	p	P
307	h 4305	10 15	28 40	31 10	175 30	43.032	37.968	—0.2	n	A
308	β	10 16	273 48	278 10	175 30	...	...	—0.5	p	A
309	Σ 1440	10 24	341 40	344 10	355 30	42.763	38.218	—0.3	n	A
310	h 4337	10 32	249 0	249 30	175 30	40.996	38.010	—0.7	p	A
311	Σ 1474	10 42	12 20	13 50	355 30	41.517	39.482	—0.3	n	P
312	...	...	192 30	193 0	175 30	41.487	39.494	—0.8	n	I
313	Σ 1500	10 54	308 25	310 20	355 30	40.714	40.268	+0.1	n	A
314	...	...	302 20	307 50	355 30	...	...	—0.3	n	I
315	...	...	307 10	308 30	355 30	40.695	40.282	0.0	p	A
316	...	...	295 20	309 10	355 30	...	...	—0.2	p	I
317	O. S.	10 54	150 40	150 45	175 30	40.448	38.600	—0.6	n	A
318	H i 77	10 56	192 25	192 55	175 30	39.906	39.089	—0.3	p	A
319	Σ 1506	10 59	29 35	30 50	175 30	42.074	38.865	—0.3	n	A
320	...	...	30 55	31 0	175 30	...	...	0.0	n	I
321	...	...	29 5	32 5	175 30	42.068	38.981	—0.2	p	A
322	...	...	28 50	30 50	175 30	...	...	—0.1	p	I
323	β 220	11 7	319 32	318 45	355 30	40.632	40.354	—0.2	n	P
324	Σ 1529	11 13	245 30	246 50	355 30	41.885	39.057	0.0	p	P
325	β 26	11 18	...	...	...	40.848	40.081	0.0	p	A
326	...	...	239 30	241 10	175 30	...	...	—0.1	p	III
327	S 627 A, ½(B+C)	11 23	327 0	327 35	355 30	44.635	36.289	—0.2	n	A
328	...	...	325 40	326 0	355 30	44.610	36.345	—0.1	p	A
329	... B,C	...	39 5	40 20	175 30	...	...	+0.4	n	A
330	Jacob 143	11 24	255 15	255 50	175 30	40.681	38.328	—0.2	p	A

Number.	Position Angle.		Distance.		Magnitudes.	Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.				
	°	°	″	″				
301	85.8	...	10.57	...	...	80.218	E	
302	216.8	217.1	7.11	7.03	7.5 8.5	80.223	S	
303	217.4	217.6	...	...	...	80.223	S	
304	237.9	239.0	0.6e	0.62	7.0 8.0	80.223	S	
305	279.1	277.1	1.98	2.10	...	80.218	E	
306	280.0	...	1.94	...	...	80.218	E	
307	214.4	214.5	17.28	17.20	7.3 8.8	80.223	S	
308	100.5	101.4	1.0e	...	8.5 11.0	80.245	S	Principal star white.
309	347.4	347.9	15.51	15.43	7.0 9.0	80.245	S	
310	73.8	72.0	10.19	10.31	8.5 10.0	80.218	E	
311	17.6	...	6.94	...	...	80.215	S	
312	17.2	...	6.80	...	7.0 7.0	80.215	S	
313	313.9	314.6	1.52	1.44	...	80.223	S	
314	309.6	...	...	...	...	80.223	S	
315	312.3	313.0	1.41	1.41	8.0 8.0	80.223	S	Both stars white.
316	306.8	...	...	...	...	80.223	S	
317	335.2	335.1	6.31	6.30	...	80.218	E	Too faint to measure easily.
318	17.2	15.3	2.79	2.91	...	80.218	E	
319	214.7	214.8	10.95	10.87	7.0 9.0	80.245	S	
320	215.5	...	...	...	...	80.245	S	
321	215.1	215.2	10.54	10.54	...	80.245	S	
322	214.3	...	...	...	...	80.245	S	
323	323.6	...	0.95	...	6.0 7.0	80.215	S	
324	250.7	...	9.65	...	6.5 7.5	80.215	S	
325	...	...	2.62	2.62	...	80.333	S	Very poor definition.
326	64.8	65.4	...	...	...	80.333	S	Very poor definition.
327	331.8	331.5	28.48	28.40	6.0 ...	80.294	S	Poor definition; white.
328	330.3	330.8	28.21	28.21	...	80.294	S	
329	224.2	224.9	0.8e	0.82	8.0 9.0	80.294	S	Poor definition; white.
330	80.0	78.2	8.03	8.15	...	80.368	E	

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
331	H iii 96	11 26	204 0	204 35	175 30	40.738	38.073	—0.3	n	A
332	...	...	204 50	205 25	175 30	40.682	38.270	—0.2	n	I
333	...	...	205 50	206 25	175 30	40.750	38.150	—0.5	p	A
334	...	...	204 55	205 0	175 30	40.677	38.218	—0.2	p	I
335	β 456	11 31	249 50	249 0	355 30	...	...	0.0	p	A
336	h 4478	11 47	340 0	341 35	355 30	40.764	40.206	0.0	n	A
337	...	...	338 50	341 40	355 30	40.798	40.191	—0.4	...	...
338	h 4479	11 47	268 40	269 15	175 30	40.504	38.488	—0.3	n	A
339	h 4481	11 51	192 5	193 5	355 30	...	...	...	n	A
340	Σ 1593	11 57	11 50	15 40	355 30	40.702	40.285	—0.3	n	A
341	h 4496	12 0	203 20	203 20	175 30	41.280	37.713	—0.2	n	A
342	Σ 1605	12 4	272 50	273 20	355 30	42.986	36.998	—0.1	p	A
343	Σ 3080	12 5	193 20	196 40	355 30	...	...	—0.2	n	A
344	Σ 1635	12 15	348 40	349 45	175 30	42.428	38.488	—0.2	n	A
345	O. S. 71	12 19	324 50	327 0	355 30	42.485	38.519	—0.2	n	A
346	Sh 145	12 24	209 35	209 25	355 30	43.063	35.900	—0.2	n	A
347	Σ 1649	12 25	190 5	190 50	355 30	41.725	38.209	—0.4	n	A
348	Σ 1664	12 32	244 0	244 45	355 30	43.620	37.367	—0.6	p	A
349	...	...	243 50	243 50	355 30	...	...	—0.2	p	I
350	β 607	12 35	311 20	313 20	355 30	40.665	40.326	—0.1	n	A
351	...	...	305 55	307 30	355 30	40.652	40.337	0.0	p	A
352	Σ 1670	12 36	331 55	333 10	175 30	41.262	39.710	—0.4	n	A
353	...	...	332 5	332 45	175 30	41.281	39.711	—0.9	n	P
354	...	...	331 5	332 55	175 30	41.383	39.716	—0.6	n	I
355	...	...	152 40	153 20	355 30	40.219	38.709	—1.0	n	A
356	...	...	332 35	332 15	175 30	40.237	38.741	—0.1	n	A
357	...	...	151 40	152 0	335 30	40.252	38.776	—0.3	n	A
358	...	...	152 0	153 30	355 30	40.213	38.738	—0.3	n	A
359	...	...	332 20	332 5	175 30	40.178	38.818	+0.1	n	I
360	...	...	153 10	152 40	355 30	40.060	38.943	—0.8	n	I

Number.	Position Angle.		Distance.		Magnitudes.	Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.				
	°	°	″	″				
331	28.8	28.7	9.10	9.09	...	80.218	E	
332	29.6	...	8.23	...	...	80.218	E	
333	30.6	28.8	8.87	8.99	...	80.218	E	
334	29.5	...	8.39	...	...	80.218	E	
335	253.9	255.2	0.7e	0.72	9.5 9.5	80.245	S	
336	345.3	345.4	1.90	1.82	4.0 5.0	80.245	S	
337	344.8	344.8	2.07	1.99	5.0 7.0	80.223	S	Disturbed by atmospheric elongation; principal star white.
338	93.5	93.4	6.88	6.87	8.0 9.5	80.360	E	
339	197.1	196.9	...	...	...	80.368	E	Too blurry for distance.
340	18.2	18.7	1.42	1.34	8.0 8.0	80.333	S	Poor definition.
341	27.8	27.8	12.17	12.16	8.0 9.0	80.360	E	
342	277.6	277.8	20.44	23.85	7.8 8.8	80.294	S	Mic. I assumed 43.986 in reduction.
343	199.5	199.6	5.e	...	8.0 9.5	80 349	S	Too faint for distance.
344	173.7	173.5	13.45	13.37	7.5 8.5	80.349	S	Both stars white.
345	330.4	330.0	13.54	13.46	8.0 10.5	80.333	S	Poor definition; principal star white.
346	214.0	214.0	24.44	24.43	4.0 9.0	80.360	E	
347	195.0	194.9	12.00	15.40	...	80.223	E	Mic. II assumed 37.209 in reduction.
348	248.9	249.2	21.34	21.34	7.0 8.5	80.322	S	Color of principal star 2.10.
349	248.3	...	...	...	...	80.322	S	
350	316.8	316.9	1.16	1.08	...	80.341	S	
351	311.2	312.1	1.08	1.08	9.0 11.0	80.341	S	
352	157.0	156.9	5.30	5.22	Diff.=0.2	80.376	S	Colors 5.18 5.18.
353	156.9	...	5.36	...	...	80.215	S	
354	156.5	...	5.69	...	...	80.376	S	
355	157.5	157.4	5.15	5.14	...	80.218	E	Miserable definition.
356	156.9	156.8	5.10	5.09	...	80.360	E	
357	156.3	156.2	5.04	5.03	...	80.371	E	
358	157.2	157.1	5.04	5.03	...	80.376	E	
359	156.7	...	4.64	...	...	80.360	E	
360	157.4	...	3.81	...	=	80.376	E	

Number.	Double Star.	Mean R.A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
361	O. S.	12 40	270 25	270 0	358 17	40.882	...	0.0	p	A
362	Σ 1690	12 50	323 15	323 20	175 30	41.364	39.604	—0.1	n	A
363	...	...	320 5	321 20	175 30	...	...	0.0	p	A
364	0 Σ 256	12 50	243 25	243 40	355 30	39.588	39.385	—0.2	p	A
365	O. S.	12 52	239 5	240 35	175 30	40.788	40.196	—0.2	n	A
366	...	...	239 20	240 25	175 30	40.818	40.200	—0.2	p	A
367	...	...	239 35	240 15	175 30	...	...	0.0	p	I
368	...	...	243 30	242 55	175 30	39.781	39.218	—0.4	p	A
369	Σ 1704	12 53	227 20	229 0	175 30	33.505	27.472	—0.4	p	A
370	A. G. C. 5	12 54	325 45	326 45	175 30	40.683	40.293	—0.2	n	A
371	...	...	323 40	323 35	175 30	...	...	—0.1	p	A
372	...	...	146 45	148 30	355 30	39.644	39.262	0.0	...	...
373	β	12 58	224 40	226 10	355 30	...	...	—0.1	p	VI
374	β 609	13 5	172 15	173 5	175 30	...	...	—0.2	n	A
375	...	...	348 20	351 20	355 30	...	...	...	...	...
376	β 221	13 7	217 45	224 30	175 30	40.733	40.253	—0.2	n	A
377	...	...	219 35	223 50	175 30	40.707	40.270	—0.3	p	A
378	H ii 45	13 7	207 50	209 10	175 30	41.272	39.714	—0.4	n	A
379	...	...	29 0	29 20	355 30	41.330	39.683	—0.3	n	I
380	...	...	207 10	209 0	175 30	...	...	—0.4	p	A
381	...	...	29 15	29 45	355 30	...	...	—0.4	p	I
382	...	...	210 30	210 55	175 30	40.230	38.688	—0.5	p	A
383	...	...	210 5	210 30	175 30	40.218	38.744	—0.2	p	A
384	β 342	13 9	27 20	30 10	355 30	41.086	39.908	+0.4	n	A
385	...	...	...	...	...	41.053	39.918	+0.4	n	A
386	...	...	27 20	29 35	355 30	...	...	+0.4	p	A
387	...	...	210 50	211 30	175 30	40.108	38.917	—0.3	n	A
388	...	...	210 0	211 0	175 30	40.073	38.921	—0.3	p	A
389	O. S.	13 9	329 0	329 0	355 30	...	...	—0.2	n	A
390	O. S.	13 15	168	177	358 13	...	...	—2.5	p	VI

Number.	Position Angle.		Distance.		Magnitudes.		Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.					
	°	°	″	″					
361	271.9	272.4	2.6	...	9.0	9.5	79.355	S	
362	147.8	147.5	6.01	5.93	7.5	9.0	80.322	S	
363	145.2	145.8	...	...	...		80.322	S	
364	248.0	245.6	0.69	0.81	...		80.371	E	
365	64.3	64.9	2.02	1.94	8.0	8.0	80.333	S	Poor definition.
366	64.4	64.8	2.11	2.11	7.5	8.0	80.349	S	Both stars white.
367	64.4	...	...	...	...		80.349	S	
368	67.7	65.7	1.92	2.04	...		80.223	E	
369	52.7	52.9	20.59	20.59	6.0	10.0	80.363	S	
370	150.8	150.9	1.33	1.25	6.0	8.0	80.376	S	
371	148.1	149.0	...	...	...		80.376	S	
372	152.1	151.6	1.30	1.29	...		80.376	E	Unsatisfactory.
373	229.9	227.3	0.6e	0.62	...		80.346	E	
374	357.2	357.7	0.8e	0.82	7.0	10.0	80.338	S	Principal star white.
375	354.3	354.7	...	...	...		80.341	S	
376	45.6	46.2	1.64	1.56	...		80.363	S	
377	46.2	46.7	1.49	1.49	8.0	10.0	80.363	S	
378	33.0	33.2	5.32	5.24	...		80.366	S	Poor definition.
379	33.7	...	5.62	...	...		80.366	S	
380	32.6	32.8	...	...	...		80.366	S	Poor definition.
381	34.0	...	...	...	...		80.366	S	
382	35.2	33.4	5.26	5.38	...		80.223	E	
383	34.8	33.0	5.03	5.15	...		80.371	E	
384	33.2	33.4	4.02	3.94	8.0	8.5	80.379	S	
385	...	...	3.87	3.79	...		80.379	S	
386	33.0	33.2	...	...	...		80.379	S	
387	35.7	35.6	4.06	4.05	...		80.379	E	
388	35.0	33.2	3.93	4.05	8.0	8.5	80.379	E	
389	333.5	333.5	...	...	8.0	10.0	80.360	E	Too faint for distance.
390	174.3	175.1	0.4e	0.42	7.5	7.5	79.300	S	

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
391	Σ 1742	13 18	344 50	347 50	355 30	40.687	40.279	—0.1	n	A
392	...	...	336 20	349 20	355 30	...	...	0.0	n	I
393	...	...	166 35	166 10	175 30	39.672	39.285	—0.2	n	A
394	...	...	166 10	165 55	175 30	39.630	39.334	—0.1	n	A
395	O. S.	13 20	347 50	351 20	355 30	40.750	40.270	—0.1	n	A
396	h 2653	13 23	231 15	233 45	355 30	43.506	37.414	—0.1	p	A
397	β 114	13 28	312 0	314 20	175 30	40.764	40.249	—0.2	n	A
398	...	...	314 40	315 30	175 30	...	...	—0.3	n	A
399	...	...	310 5	312 0	175 30	...	...	0.0	n	I
400	...	...	309 0	310 50	175 30	40.695	40.305	—0.1	p	A
401	...	...	309 55	311 0	175 30	...	...	—0.2	p	A
402	...	...	304 55	309 25	175 30	...	...	+0.1	p	I
403	H n 69	13 30	6 40	8 40	175 30	42.003	39.003	+0.1	n	A
404	...	...	187 10	187 35	355 30	40.962	38.048	—0.5	n	A
405	O. S.	13 31	256 50	259 35	355 30	41.160	39.819	+0.1	p	A
406	Σ 1763	13 31	215 40	216 40	175 30	40.949	40.055	+0.1	n	A
407	...	...	214 5	217 5	175 30	40.972	40.056	—0.1	n	I
408	...	...	216 5	216 50	175 30	40.916	40.070	0.0	p	A
409	...	...	215 5	214 10	175 30	40.930	39.990	—0.1	p	I
410	h 4604	13 34	273 50	275 50	355 30	42.764	38.233	—0.3	p	A
411	...	...	276 40	276 10	355 30	41.807	38.208	0.0	p	A
412	...	...	275 40	275 15	355 30	41.766	38.332	—0.3	p	A
413	h 2671	13 37	247 0	246 45	175 30	43.576	35.423	—0.1	p	A
414	...	...	247 0	247 45	175 30	43.495	35.399	—0.2	p	A
415	h 2674	13 38	180 55	180 30	175 30	42.811	38.089	—0.2	n	A
416	Σ 3081	13 39	240 10	244 55	175 30	40.770	40.170	+0.1	p	A
417	...	...	245 30	245 40	175 30	39.752	39.172	—0.3	p	A
418	β A,B	13 40	296 25	298 5	355 30	...	...	+0.2	n	A
419	...	...	296 35	296 55	355 30	40.230	39.750	+0.4	n	A
420	...	...	292 25	294 25	355 30	40.208	39.753	+0.3	p	A

Number.	Position Angle.		Distance.		Magnitudes.	Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.				
	°	°	″	″				
391	350.8	351.0	1.39	1.31	7.5 . 8.0	80.363	S	
392	347.3	...	...	...	...	80.363	S	
393	350.9	350.4	1.32	1.31	...	80.223	E	
394	350.5	350.0	1.01	1.00	...	80.346	E	
395	354.1	354.2	1.64	1.56	8.0 9.0	80.349	S	
396	237.0	237.2	20.79	20.79	8.0 12.0	80.338	S	Principal star white.
397	137.7	137.6	1.76	1.68	7.8 8.0	80.322	S	
398	139.6	139.5	...	...	8.0 8.0	80.333	S	Poor definition.
399	135.5	...	...	...	...	80.333	S	
400	134.4	135.2	1.33	1.33	...	80.322	S	
401	135.0	135.8	...	...	...	80.333	S	Poor definition.
402	131.7	...	...	...	...	80.333	S	
403	192.2	192.2	10.24	10.16	6.8 7.8	80.376	S	
404	191.9	191.8	9.94	9.93	6.0 7.5	80.376	E	Both stars white.
405	262.7	263.1	4.58	4.58	8.5 11.0	80.423	S	
406	40.7	41.1	3.05	2.97	...	80.366	S	Poor definition.
407	40.1	...	3.13	...	...	80.366	S	
408	41.0	41.3	2.89	2.89	7.0 8.0	80.366	S	Poor definition.
409	39.1	...	3.21	...	...	80.366	S	
410	279.3	279.6	15.46	15.46	8.0 10.0	80.420	S	
411	280.9	279.2	15.70	15.82	9.0 11.0	80.346	E	
412	280.0	278.3	15.13	15.25	8.0 10.5	80.360	E	Very poor definition.
413	71.4	69.7	27.82	27.94	9.0 9.5	80.360	E	
414	71.9	70.2	27.63	27.75	9.0 10.0	80.398	E	
415	5.2	5.2	16.12	22.93	8.0 9.0	80.423	E	Mic. readings changed 2 rev. in reduction.
416	67.0	67.4	2.05	2.05	8.0 8.5	80.442	S	
417	70.1	68.1	1.98	2.10	...	80.223	E	
418	301.8	301.5	...	...	...	80.420	S	
419	301.2	300.4	1.64	1.69	...	80.420	H	
420	297.9	297.7	1.55	1.57	...	80.420	H	

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
421	h 4617	13 44	253 30	255 35	355 30	40.187	39.816	—0.1	p	A
422	h 4637	13 51	313 5	313 30	175 30	41.418	37.632	—0.5	n	A
423	...	...	215 25	214 10	175 30	41.383	37.594	—0.1	p	A
424	β 344	13 52	300 20	303 15	175 30	40.983	39.988	—0.2	n	A
425	...	...	296 10	297 35	175 30	40.977	39.988	—0.1	p	A
426	h 4650	14 0	237 20	238 0	175 30	...	...	—0.1	p	A
427	h 4661	14 5	222 20	224 50	175 30	...	...	—0.2	p	A
428	...	...	227 0	226 45	175 30	...	...	—0.2	p	A
429	h 4664	14 8	191 15	191 10	175 30	42.100	36.896	—0.1	n	A
430	...	...	190 25	189 40	175 30	42.102	36.882	—0.4	n	A
431	...	...	190 0	189 25	175 30	42.062	37.864	—0.2	n	A
432	H. A. H. 27	14 11	246 55	248 0	175 30	41.342	39.589	—0.4	p	A
433	β 116	14 13	275 10	276 15	355 30	39.914	39.048	—0.4	p	A
434	Σ 1833	14 16	162 25	163 20	175 28	40.321	38.706	0.0	n	A
435	O. S.	14 18	262 40	268 30	355 30	...	...	—0.5	p	A
436	...	...	277 45	278 35	355 30	...	...	—0.4	p	A
437	β 225	14 19	273 10	275 25	175 30	40.709	40.320	—0.2	p	A
438	...	...	280 10	280 10	175 30	39.659	39.284	—0.3	p	A
439	Σ 1847	14 22	253 45	254 25	355 30	42.911	36.136	—0.2	p	A
440	...	...	254 30	255 0	355 30	42.788	36.136	+0.2	p	I
441	H. V. E.	14 23	193 25	195 40	175 30	41.032	39.957	—0.2	n	A
442	...	...	10 50	14 10	355 30	41.043	39.973	—0.1	...	...
443	...	...	194 45	195 20	355 30	40.091	39.905	—0.8	n	A
444	...	...	194 25	194 50	355 30	40.020	39.939	—0.1	n	A
445	...	...	193 35	195 50	355 30	40.039	38.973	—0.3	n	A
446	β 117	14 25	266 30	267 30	175 30	40.833	40.128	—0.1	p	A
447	h 2723	14 25	132 35	132 45	355 30	43.496	35.514	0.0	n	A
448	W. M. C. Z.	14 30	286 0	286 25	175 30	43.490	37.517	—0.2	p	A
449	...	...	288 20	289 0	175 30	42.384	36.578	—0.1	p	A
450	β 226	14 32	256 30	259 5	175 30	40.634	40.349	0.0	p	A

Number.	Position Angle.		Distance.		Magnitudes.		Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.					
	°	°	″	″					
421	259.0	259.7	1.27	1.27	8.0	10.0	80.338	S	Principal star white.
422	137.8	137.8	12.92	12.91	...		80.371	E	Distance unsatisfactory.
423	139.3	137.6	12.93	13.05	9.0	9.5	80.376	E	
424	126.3	126.0	3.40	3.32	8.0	9.0	80.330	S	
425	121.4	122.0	3.38	3.30	...		80.330	S	
426	62.2	60.5	...	...	9.0	12.0	80.346	E	Comp. too faint for distance.
427	48.1	48.5	...	...	...		80.363	S	Too poor definition for distance.
428	51.4	49.4	...	...	...		80.398	E	Clouds.
429	15.7	15.7	17.76	17.75	8.5	9.0	80.346	E	
430	14.5	14.5	17.82	17.81	...		80.371	E	
431	14.2	14.2	14.33	17.73	8.0	9.0	80.423	E	Mic. II assumed 36.864 in reduction.
432	72.0	72.4	5.99	5.99	8.0	9.0	80.349	S	
433	280.2	278.3	2.96	3.08	...		80.368	E	Poor definition.
434	167.4	167.3	5.51	5.50	6.0	6.5	80.448	E	
435	270.1	271.0	0.8e	0.82	8.0	9.5	80.379	S	
436	282.7	280.1	...	...	8.0	9.0	80.379	E	
437	98.8	99.5	1.33	1.33	8.0	9.0	80.376	S	
438	104.7	102.6	1.28	1.40	8.0	9.5	80.376	E	
439	258.6	256.9	23.12	23.24	...		80.366	E	Poor definition; distance unsatisfactory.
440	259.2	...	22.70	...	...		80.366	E	
441	19.0	19.1	3.67	3.59	8.7	9.2	80.371	S	
442	17.0	17.1	3.65	3.57	8.5	9.0	80.379	S	
443	199.5	199.4	4.05	4.04	...		80.223	E	Mic. II. assumed 38.905 in reduction.
444	199.1	199.0	3.69	3.68	...		80.322	E	Very faint; Mic. II. assumed 38.939 in reduction.
445	199.2	199.1	3.64	3.63	8.5	10.0	80.379	E	
446	91.5	92.0	2.41	2.41	7.5	8.5	80.330	S	
447	137.2	137.2	27.24	27.23	8.0	10.5	80.407	E	
448	110.7	111.1	20.38	20.38	7.0	8.0	80.360	S	Both stars white.
449	113.2	111.5	19.81	19.93	9.0	9.5	80.349	E	Companion difficult to see.
450	82.3	83.1	0.97	0.97	8.0	8.0	80.338	S	Both stars white.

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
451	β 345	14 35	292 10	295 35	355 30	40.633	40.367	0.0	p	A
452	Σ 1869	14 36	307 35	307 45	175 30	44.300	36.680	—0.1	n	A
453	...	...	306 5	306 20	175 30	44.285	36.701	0.0	p	A
454	Sh 184	14 39	305 5	305 50	175 30	41.827	39.195	—0.4	n	A
455	...	...	303 30	304 50	175 30	41.788	39.180	—0.3	p	A
456	Σ 1876	14 40	247 50	249 0	175 30	39.653	39.320	—0.1	p	A
457	S 663	14 42	328 50	334 0	355 30	40.817	40.169	0.0	n	A
458	...	...	333 55	334 55	355 30	39.809	39.179	+0.3	n	A
459	β 118	14 47	305 5	305 10	355 30	39.772	39.207	—0.2	p	A
460	h 4716	14 49	352 40	353 40	355 30	40.951	40.073	—0.5	n	A
461	Sh 190	14 50	287 15	286 15	355 30	41.686	37.252	—0.1	p	A
462	β 239	14 52	304 35	306 40	355 30	40.632	40.336	—0.3	n	A
463	...	...	292 20	300 25	355 30	40.632	40.338	—0.4	p	A
464	...	...	305 48	308 15	355 30	39.623	39.378	0.0	n	A
465	...	...	304 0	304 55	355 30	39.612	39.366	—0.1	p	A
466	h 2757	14 52	266 30	268 55	175 30	42.276	38.711	—0.1	p	A
467	...	...	272 40	273 5	175 30	41.240	38.710	0.0	p	A
468	Σ 1899	14 55	244 45	245 0	178 13	44.202	35.742	—0.4	p	A
469	...	...	253 40	254 45	185 38	43.657	35.252	—0.7	p	A
470	Σ 3090	15 3	269 10	272 5	355 30	40.726	40.269	—0.4	p	A
471	...	...	274 5	275 20	355 30	39.709	39.263	—0.2	p	A
472	β 350	15 8	330 50	334 50	175 30	40.690	40.305	—0.1	n	A
473	β 352	15 11	239 20	241 55	175 30	42.612	38.368	0.0	n	A
474	...	...	238 10	239 20	175 30	42.548	38.360	—0.1	p	A
475	...	...	243 45	243 30	175 30	41.589	37.384	0.0	p	A
476	β 227	15 12	355 20	355 45	175 30	40.767	40.187	—0.1	...	...
477	h 4767	15 18	317 45	317 35	175 30	44.330	44.776	—0.4	n	A
478	...	...	318 0	317 10	175 30	44.281	34.714	0.0	n	A
479	H. V. E.	15 18	203 20	204 5	175 30	41.863	37.156	—0.5	n	A
480	h 4769	15 18	188 10	188 25	355 30	40.884	38.122	—0.2	n	A

Number.	Position Angle.		Distance.		Magnitudes.	Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.				
	°	°	″	″				
451	298.4	299.4	0.90	0.90	7.8 8.5	80.420	S	
452	132.2	131.7	26.00	25.92	8.3 9.3	80.442	S	
453	130.7	131.1	25.88	25.88	...	80.442	S	
454	130.0	129.6	8.98	8.90	5.0 7.0	80.423	S	
455	128.7	129.2	8.90	8.90	...	80.423	S	
456	72.9	70.7	1.14	1.26	...	80.322	E	
457	335.9	335.8	2.21	2.13	8.5 11.5	80.376	S	
458	338.9	338.6	2.15	2.14	9.0 11.5	80.376	E	
459	309.6	307.6	1.93	2.05	9.0 10.0	80.346	E	Poor definition.
460	357.7	357.8	3.00	2.92	9.0 10.0	80.445	S	Hazy.
461	291.2	289.5	15.13	15.25	8.0 9.5	80.349	E	Windy.
462	310.1	310.1	1.01	0.93	...	80.379	S	
463	300.9	301.8	1.00	1.00	6.0 7.0	80.379	S	Distance estimated 0″.6.
464	311.5	310.9	0.84	0.83	...	80.379	E	
465	309.0	306.7	0.84	0.96	...	80.379	E	
466	92.2	92.5	12.17	12.17	7.5 9.0	80.360	S	Principal star white.
467	97.4	95.7	12.05	12.17	9.0 10.5	80.346	E	Mic. II. assumed 37.710 in reduction.
468	66.6	66.3	28.87	28.89	7.0 10.0	79.251	H	
469	68.6	66.9	28.68	28.80	6.0 10.0	79.357	E	
470	275.1	275.7	1.56	1.56	8.0 8.0	80.371	S	
471	279.2	277.1	1.52	1.64	...	80.322	E	
472	157.4	157.5	1.31	1.23	7.0 8.0	80.445	S	
473	65.1	65.5	14.48	14.40	...	80.360	S	Poor definition.
474	63.2	63.5	14.29	14.29	7.0 9.0	80.360	S	Principal star white.
475	68.1	66.4	14.35	14.47	8.5 9.0	80.346	E	
476	180.0	180.2	1.98	1.90	7.0 9.5	80.423	S	Poor definition; principal star white.
477	142.2	142.2	32.61	32.60	...	80.366	E	Poor definition; distance unsatisfactory.
478	142.1	142.1	32.65	32.64	9.0 10.0	80.407	E	Poor definition.
479	28.2	28.2	16.06	16.05	8.5 10.5	80.398	E	
480	192.8	192.7	9.43	9.42	8.5 9.5	80.349	E	

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
481	h 4769 (*continued*)	15 18	187 15	188 0	355 30	40.885	38.090	−0.3	n	A
482	h 4774	15 22	0 25	3 30	355 30	41.810	39.140	−0.1	n	A
483	...	...	...	...	...	41.883	39.131	−0.3	...	...
484	Arg.S.54 A,B	15 34	198 20	198 25	175 30	44.759	34.304	−0.2	n	A
485	... A,C	...	143 35	143 30	175 30	...	...	−0.1	n	A
486	... A,D	...	137 40	137 0	175 30	52.422	26.348	−0.2	p	A
487	h 4807	15 41	354 50	0 5	355 30	42.015	38.960	−0.2	n	A
488	β 36	15 46	272 35	273 0	355 30	39.906	39.122	−0.4	p	A
489	Sh 213	15 52	313 25	316 10	355 30	43.093	37.858	−0.2	n	A
490	...	...	313 10	314 25	355 30	43.112	37.897	−0.1	p	A
491	...	...	315 35	315 35	355 30	42.112	36.904	−0.7	n	A
492	...	...	315 15	315 10	355 30	42.094	36.868	0.0	p	A
493	h 4826	15 55	239 35	244 25	355 30	41.224	39.749	−0.3	p	A
494	...	...	246 45	245 40	355 30	40.218	38.789	−0.3	p	A
495	β 38	15 56	166 40	167 30	175 28	40.086	38.889	−0.9	n	A
496	Σ 1998 A,B	15 58	183 45	184 15	355 30	39.668	39.268	−0.8	n	A
497	...	...	186 45	184 30	355 30	39.622	39.364	−0.7	n	A
498	... A,C	...	249 50	250 15	175 30	40.510	38.477	−0.6	p	A
499	β 39	16 1	250 35	252 50	355 30	40.953	40.011	−0.2	p	A
500	...	...	251 15	252 25	355 28	40.948	40.011	−0.6	p	A
501	h 4839	16 5	248 50	251 55	175 30	41.160	39.813	−0.1	p	A
502	...	...	255 50	256 45	175 30	40.078	38.908	−0.2	p	A
503	β 120 A,B	16 5	178 35	176 15	175 30	...	...	−0.2	n	A
504	... C,D	...	220 30	220 55	175 30	39.782	39.212	−0.3	p	A
505	Σ 2023	16 9	227 45	225 45	355 30	...	...	−0.1	n	A
506	β 624	16 16	316 25	317 30	355 30	...	...	−0.4	n	A
507	O. S.	16 20	157 18	161 52	175 30	41.804	39.116	+0.1	n	A
508	Σ 2046	16 20	221 55	223 50	358 13	41.726	39.298	−3.3	n	A
509	Σ 3105	16 25	217 15	218 28	175 30	...	...	0.0	p	A
510	...	...	219 35	220 35	175 30	...	...	+0.2	p	A

Number.	Position Angle.		Distance.		Magnitudes.	Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.				
	°	°	″	″				
481	192.1	192.0	9.54	9.53	8.0 9.5	80.398	E	
482	6.5	6.5	9.11	9.03	6.0 10.0	80.338	S	Principal star white.
483	...	...	9.39	9.31	7.5 10.0	80.437	S	
484	22.9	22.9	35.68	35.67	8.5 9.0	80.349	E	Blurry.
485	328.0	328.0	60.e	...	... 10.5	80.349	E	Too faint for distance.
486	321.8	320.1	88.98	89.10	... 9.5	80.349	E	Distance unsatisfactory.
487	2.0	1.9	10.43	10.35	8.0 11.0	80.442	S	
488	277.3	275.4	2.68	2.80	5.0 7.5	80.379	E	
489	319.3	318.9	17.87	17.79	8.0 9.0	80.376	S	
490	318.3	318.8	17.80	17.80	...	80.376	S	
491	320.1	320.1	17.77	17.76	8.0 8.3	80.376	E	
492	319.7	318.0	17.84	17.96	...	80.376	E	
493	246.5	246.8	5.03	5.03	9.0 9.5	80.423	S	
494	250.8	249.0	4.88	5.00	9.0 10.0	80.420	E	Poor definition; both stars white.
495	351.6	351.5	4.08	4.07	8.5 10.0	80.478	E	Poor definition.
496	188.5	188.0	1.37	1.36	...	80.322	E	Became very blurry.
497	190.1	189.6	0.88	0.87	...	80.398	E	
498	74.5	72.7	6.94	7.06	...	80.398	E	
499	256.2	256.7	3.21	3.21	5.0 8.8	80.442	S	Windy during measure of distance.
500	256.4	256.9	3.20	3.20	6.0 9.0	80.478	S	
501	74.9	75.4	4.60	4.60	6.0 8.5	80.423	S	Poor definition. Color of principal star 2.22.
502	80.8	79.0	3.99	4.11	6.0 8.0	80.420	E	
503	1.9	1.0	...	...	...	80.398	E	Only elongated.
504	45.2	43.2	1.95	2.07	...	80.398	E	
505	231.2	230.8	...	...	...	80.322	E	Too poor definition for distance.
506	321.5	320.9	1.e	...	...	80.379	E	
507	344.1	344.0	9.17	9.09	8.0 11.0	80.420	S	
508	224.6	224.3	8.29	8.21	9.0 10.0	79.313	S	
509	42.4	43.5	0.7e	0.72	8.0 8.0	80.376	S	
510	44.6	41.9	...	...	8.0 8.5	80.376	E	

Number.	Double Star.	Mean R.A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
511	Σ 3106	16 49	240 30	241 40	175 28	...	...	—0.7	p	A
512	...	...	243 5	244 15	355 30	39.822	39.189	—0.6	p	A
513	Sh 240	16 50	227 5	228 0	355 31	41.198	39.782	—0.2	p	A
514	...	...	226 30	226 40	355 30	40.188	38.798	—0.7	p	A
515	h 4902	16 50	24 35	26 0	355 28	42.129	38.849	0.0	n	A
516	...	...	204 45	205 55	175 28	...	...	—0.1	p	A
517	h 589	17 3	297 50	298 10	355 28	40.902	38.072	—0.5	p	A
518	Σ 2132	17 6	289 2	284 52	175 30	...	...	—1.6	n	A
519	...	...	285 5	281 35	175 30	...	...	—1.6	...	...
520	Sh 243	17 8	16 10	18 0	355 31	41.125	39.864	—0.3	n	A
521	...	...	16 45	18 50	355 31	41.149	39.842	0.0	n	I
522	β 282	17 8	327 30	330 20	175 28	41.125	39.857	+0.2	n	A
523	h 4932	17 9	223 20	223 30	355 28	40.921	38.027	—0.1	p	A
524	O. S.	17 11	285 30	285 5	355 30	41.941	36.994	—0.9	p	A
525	...	...	286 30	287 10	355 31	41.932	37.061	—0.1	p	A
526	O. S.	17 14	216 15	220 35	175 30	...	...	—0.1	n	A
527	...	...	218 35	220 35	175 30	...	...	—0.2	p	A
528	h 4953	17 19	169 25	170 5	355 30	42.152	36.821	—0.8	n	A
529	...	...	170 15	169 10	355 30	42.142	36.832	—0.1	n	A
530	Arg. S. 66	17 23	10 0	11 5	175 30	40.731	38.248	—0.6	n	A
531	Σ 2173	17 24	294 30	294 15	...	...	...	—0.2	p	VI
532	...	...	294 0	296 30	...	...	...	—0.3	p	A
533	Σ 2183 rej. A,B	17 29	8 15	9 35	355 30	44.643	36.328	0.0	n	A
534	Σ 2191	17 34	266 45	265 45	358 17	43.397	35.523	—0.3	p	A
535	...	...	264 15	264 5	355 31	43.362	35.626	—0.2	p	A
536	Arg. S. 67	17 36	287 50	287 10	355 30	44.871	34.122	—0.4	p	A
537	H. A. H.	17 45	184 35	184 45	175 30	40.443	38.548	—0.2	n	A
538	...	...	183 50	183 45	175 28	40.458	38.516	—0.3	n	A
539	W. M. C. Z.	17 46	356 0	358 30	175 28	41.278	40.641	0.0	n	III
540	Σ 2244	17 51	269 15	269 15	...	40.652	40.278	—0.4	p	A

Number.	Position Angle.		Distance.		Magnitudes.		Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.					
	°	°	″	″					
511	65.6	66.2	...	...	9.0	9.0	80.478	S	
512	248.2	246.2	2.16	2.28	...		80.398	E	
513	232.0	232.3	4.83	4.83	6.0	7.5	80.560	S	
514	231.1	229.3	4.74	4.86	7.0	8.0	80.379	E	
515	29.8	29.9	11.19	11.11	...		80.442	S	
516	29.9	30.0	...	...	8.0	9.0	80.442	S	
517	302.5	300.7	9.66	9.78	8.5	9.5	80.459	E	
518	111.5	111.3	...	...	8.0	9.0	80.439	S	Too poor definition for distance.
519	107.8	108.5	...	...	...		80.439	S	
520	21.6	21.8	4 30	4.22	...		80.596	S	
521	22.3	...	4.46	...	...		80.596	S	
522	153.4	153.1	4.33	4.25	6.0	10.5	80.442	S	
523	228.0	226.2	9.88	10.00	8.5	10.5	80.459	E	Distance poor.
524	289.8	288.1	16.88	17.00	...		80.349	E	
525	291.3	289.6	16.62	16.74	8.0	8.5	80.579	E	
526	42.9	43.7	0.8e	0.82	...		80.398	S	
527	44.1	44.9	...	...	8.5	9.5	80.398	S	
528	174.2	174.2	18.19	18.18	8.5	9.5	80.379	E	Difficult.
529	174.2	174.2	18.12	18.11	...		80.420	E	
530	195.0	194.9	8.47	8.46	...		80.379	E	
531	...	...	0.5e	0.52	...		80.554	S	
532	...	...	...	...	6.0	6.5	80.554	S	
533	13.4	13.4	28.38	28.30	7.0	9.0	80.398	S	
534	268.0	266.3	26.87	26.99	8.0	9.0	79.355	E	
535	268.6	266.9	26.40	26.52	7.0	7.5	80.557	E	
536	292.0	290.3	36.69	36.81	8.0	8.5	80.379	E	
537	9.2	9.2	6.47	6.46	9.0	10.0	80.420	E	Difficult.
538	8.3	8.2	6.63	6.62	8.0	9.5	80.459	E	
539	1.8	2.2	2.17	2.01	10.0	11.0	80.516	S	
540	...	...	1.28	1.28	7.0	7.3	80.554	S	

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
541	Σ 2244 (*continued*)	17 51	270 25	272 45	355 31	40.684	40.275	—0.8	p	A
542	Σ 2262	17 57	245 20	246 10	355 31	40.784	40.164	—0.6	p	A
543	...	...	244 20	251 45	355 31	...	...	—0.5	p	I
544	...	...	247 50	248 0	358 13	40.237	39.777	+0.8	p	A
545	...	...	247 20	247 5	355 30	39.710	39.273	—0.4	p	A
546	h 5009	17 57	195 55	195 15	175 30	40.071	38.938	—0.7	n	A
547	H. V. E.	17 57	11 20	11 40	355 31	40.155	38 846	—0.3	n	A
548	h 5010	17 57	344 5	344 20	355 44	41.083	40.013	—0.3	n	A
549	Σ 2272	17 59	244 45	248 20	178 13	40.946	40.058	+0.4	p	A
550	...	...	248 35	247 25	178 17	40.947	40.133	—1.3	p	A
551	...	...	245 20	245 50	178 13	40.973	40.037	+0.7	p	III
552	...	...	238 40	240 30	175 31	40.940	40.042	0.0	...	...
553	...	...	249 50	248 50	178 13	40.441	39.592	+0.5	p	A
554	...	...	242 40	242 50	175 30	39.869	39.144	0.0	p	A
555	...	...	247 5	247 20	175 30	39.862	39.142	—0.2	p	I
556	O. S. 88	18 0	274 0	274 15	355 31	42.390	36.621	—0.1	p	A
557	β 244	18 1	254 25	255 10	355 31	39.771	39.218	—0.5	p	A
558	β 132	18 4	242 5	240 20	178 13	...	...	—0.2	p	A
559	...	...	233 20	234 48	355 31	39.638	39.328	0.0	p	A
560	...	...	235 0	235 0	355 31	39.604	39.355	—0.2	p	A
561	h 5035	18 7	254 0	255 0	355 28	42.976	37.966	0.0	p	A
562	β 131	18 7	276 0	278 0	355 31	39.872	39.113	0.0	p	A
563	h 2823	18 8	327 10	329 5	355 31	43.454	37.505	—0.2	n	A
564	...	...	147 35	148 0	175 30	42.478	36.479	—0.1	n	A
565	β 285	18 9	317 25	321 55	355 31	...	...	—0.4	n	A
566	h 2827	18 10	248 50	248 30	355 31	42.434	36.562	0.0	p	A
567	Sh 264	18 12	229 10	229 40	178 13	43.058	37.960	—0.2	p	A
568	β 48	18 14	176 15	176 35	175 31	39.853	39.159	—0.5	n	A
569	O. S.	18 16	261 25	263 20	178 13	41.465	39.495	—0.3	p	A
570	β 49	18 17	218 0	222 45	175 28	...	...	+0.1	...	...

Number.	Position Angle.		Distance.		Magnitudes.		Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.					
	°	°	″	″					
541	276.1	276.9	1.40	1.40	7.0	8.0	80.560	S	Distance measured with dark wires.
542	250.2	250.7	2.12	2.12	5.5	6.5	80.560	S	Distance measured with dark wires.
543	252.5	...	...	...	...		80.560	S	
544	249.7	248.7	1.57	1.59	...		79.267	H	Observed after sunrise.
545	251.7	249.7	1.49	1.62	...		80.379	E	
546	20.1	19.9	3.87	3.86	9.0	9.5	80.576	E	
547	16.0	15.9	4.47	4.46	9.0	9.2	80.576	E	
548	348.5	348.4	3.65	3.57	9.0	9.5	79.593	S	
549	68.3	68.8	3.03	3.03	...		79.270	S	
550	69.7	70.2	2.78	2.78	...		79.346	S	
551	67.4	67.9	3.19	3.19	...		79.270	S	
552	64.1	64.5	3.06	3.06	...		80.560	S	Distance measured with dark wires.
553	71.1	70.4	2.90	2.92	...		79.267	H	
554	67.2	65.3	2.47	2.59	...		80.379	E	
555	71.7	...	2.46	...	...		80.379	E	
556	278.6	276.9	19.69	19.81	9.0	9.5	80.574	E	Near h 592.
557	259.3	257.3	1.89	2.01	...		80.579	E	
558	63.0	63.7	0.8e	0.82	6.5	6.5	79.270	S	Tangent screw not used.
559	238.6	236.4	1.06	1.18	8.5	8.8	80.576	E	
560	239.5	237.3	0.85	0.97	...		80.579	E	Very faint.
561	259.0	259.3	17.10	17.12	5.0	9.0	80.530	S	
562	281.5	279.6	2.59	2.71	...		80.579	E	
563	332.6	332.3	20.30	20.22	8.5	9.0	80.593	S	
564	332.3	332.3	20.47	20.46	9.0	9.5	80.420	E	
565	324.2	324.2	1.2e	...	8.0	10.0	80.596	S	Poor definition.
566	253.2	251.5	20.04	20.16	9.0	9.5	80.582	E	In an oval nebula.
567	51.2	51.4	17.40	17.40	6.0	8.0	79.270	S	
568	0.9	0.6	2.37	2.36	9.0	9.5	80.582	E	
569	84.2	84.6	6.72	6.72	8.5	9.0	79.297	S	
570	44.9	45.2	...	...	...		80.516	S	

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
571	β 49 (*continued*)	18 17	219 0	220 10	175 28	...	...	—0.1	...	...
572	Jacob 201	18 18	285 50	289 5	...	40.769	40.136	—0.2	p	A
573	...	...	290 35	290 10	355 31	40.791	40.164	+0.2	...	...
574	β 247	18 26	342 50	346 20	175 31	41.568	39.370	+0.1	n	A
575	Σ 2434 B,C	18 57	237 55	240 20	175 42	40.729	40.199	+0.1	p	III
576	S 711	19 1	299 15	298 35	175 30	46.197	32.754	—0.8	n	A
577	h 1373?	19 6	237 45	237 30	175 28	40.802	38.188	—0.6	p	A
578	β 138	19 7	274 15	278 50	355 31	40.656	40.296	—0.2	p	A
579	H. A. H. 95	19 15	321 15	327 5	175 42	...	...	—0.6	n	A
580	H. A. H.	19 16	260 50	260 5	175 28	...	...	—0.2	p	A
581	...	...	257 55	258 20	175 31	...	...	—0.7	p	A
582	...	...	...	...	...	39.830	39.092	...	p	A
583	...	...	...	...	...	39.800	39.111	...	p	A
584	h 2866 A,B	19 16	230 25	230 10	175 31	42.889	36.121	—0.4	p	A
585	...	...	230 0	230 20	175 31	42.921	36.061	—0.5	p	A
586	... A,C	...	132 50	132 25	355 31	43.013	36.003	—0.4	n	A
587	... B,C	...	273 40	272 40	355 31	44.588	34.406	—0.3	p	A
588	O. S.	19 20	9 50	11 35	175 31	41.220	39.778	0.0	n	A
589	...	...	10 15	11 30	175 31	41.146	41.218	—0.7	n	III
590	β 423	19 20	293 45	297 0	175 42	40.677	40.306	—0.5	n	A
591	Σ 2541	19 30	325 35	330 45	355 31	41.035	39.920	—0.6	n	A
592	Σ 2545	19 32	316 0	316 5	355 31	40.011	38.934	—0.1	n	A
593	...	...	136 35	137 25	175 31	40.040	38.952	—0.4	n	A
594	h 5144	19 38	4 25	5 30	355 42	42.081	38.962	—0.3	n	A
595	...	...	184 45	186 50	175 42	41.961	39.031	—0.7	n	I
596	...	...	184 55	185 10	175 28	40.983	38.025	—0.2	n	A
597	A. C. 12	19 52	141 25	142 30	175 31	40.672	40.296	—0.6	n	A
598	...	...	138 25	139 30	175 31	39.639	39.326	—0.5	n	A
599	h 5164	19 54	298 55	300 55	175 42	41.857	39.123	—0.6	n	A
600	...	...	295 20	296 20	175 42	41.881	39.145	—0.5	p	A

Number.	Position Angle.		Distance.		Magnitudes.		Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.					
	°	°	″	″					
571	44.1	44.4	...	...	...		80.516	S	
572	...	...	2.16	2.16	5.0	8.0	80.554	S	
573	294.8	295.4	2.14	2.14	5.0	8.5	80.560	S	Very poor definition.
574	169.1	169.0	7.50	7.42	7.0	10.0	80.593	S	Most of the time exceedingly faint.
575	63.4	64.2	1.81	1.81	8.0	10.5	79.680	S	
576	123.4	123.4	45.88	45.87	7.5	8.5	80.379	E	Too wide for power A.
577	62.2	59.8	8.92	9.04	9.5	10.0	80.442	E	Position angle probably 239°.8.
578	281.0	281.7	1.23	1.23	8.0	10.0	80.593	S	Distance estimated 0″.8
579	148.5	149.4	0.4e	0.42	6.0	6.5	79.691	S	
580	85.0	83.0	...	...	...		80.442	E	Became too faint for distance.
581	82.6	80.6	...	...	9.0	9.3	80.576	E	Too faint for distance.
582	...	...	2.52	2.64	...		80.579	E	Very faint.
583	...	...	2.35	2.47	...		80.582	E	Light clouds; poor definition.
584	54.8	53.1	23.10	23.22	8.0	8.3	80.574	E	
585	54.6	52.9	23.41	23.53	...		80.576	E	
586	137.1	137.1	23.92	23.91	...		80.576	E	
587	277.7	276.0	34.75	34.87	8.0	8.5	80.574	E	P est = 180°.
588	195.2	195.2	4.92	4.84	6.8	7.3	80.623	S	
589	195.4	195.7	4.65	4.49	...		80.623	S	
590	119.7	119.6	1.27	1.19	7.0	8.0	79.691	S	Distance estimated 1″.0
591	332.6	332.4	3.80	3.72	8.0	10.0	80.596	S	Stars seem faint and unsatisfactory to-night.
592	320.5	320.4	3.68	3.67	7.0	8.5	80.560	E	Poor definition.
593	321.5	321.4	3.71	3.70	...		80.563	E	
594	9.3	9.3	10.64	10.56	...		79.683	S	
595	10.1	...	10.00	...	9.0	10.0	79.683	S	
596	9.6	9.5	10.10	10.09	8.0	9.0	80.516	E	
597	326.5	326.6	1.28	1.20	...		80.557	S	
598	323.4	322.8	1.07	1.06	...		80.563	E	
599	124.2	123.8	9.33	9.25	8.0	9.0	79.691	S	
600	120.1	120.6	9.34	9.34	...		79.691	S	

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
601	h 2918	19 55	129 15	130 5	355 28	41.941	37.088	—0.2	n	A
602	Σ 2646	20 8	225 25	225 10	175 31	42.861	36.108	—0.4	p	A
603	Arg. S. 84	20 15	262 40	263 0	355 42	43.114	37.859	+0.2	p	A
604	...	...	262 10	262 50	355 42	43.028	37.974	—0.1	p	I
605	H. A. H.	20 20	231 20	231 40	175 30	40.404	39.603	—0.3	p	III
606	H ii 51	20 22	348 0	347 15	175 42	41.012	40.045	—0.2	n	III
607	H iv 71	20 23	236 15	236 10	355 31	42.718	36.242	—0.3	p	A
608	O. S.	20 31	243 20	245 25	355 30	...	...	—0.1	p	A
609	...	...	236 35	240 10	355 42	40.180	39.776	—0.6	p	III
610	h 921	20 35	214 0	215 15	175 31	40.850	38.143	—0.8	p	A
611	β 267	20 35	235 0	236 10	355 44	40.835	40.238	—0.3	p	III
612	...	...	230 50	234 10	355 44	...	..	—0.3	p	I
613	β 674	20 38	98 0	103 25	355 42	...	...	—0.6	p	A
614	...	...	97 40	98 25	355 30	40.178	39.787	—0.4	p	A
615	h 5220	20 39	170 20	170 15	175 28	42.127	36.852	—0.5	n	A
616	β 154	20 46	234 35	236 30	175 42	40.922	40.081	—1.1	p	A
617	...	...	233 20	236 10	175 42	40.926	40.087	+0.1	p	A
618	...	...	54 35	54 5	355 42	40.953	40.070	—0.1	p	I
619	Σ 2745	20 58	185 10	186 40	355 31	40.989	40.050	—0.2	n	A
620	...	...	5 35	7 15	175 31	40.908	40.094	—0.5	n	A
621	...	...	3 10	7 5	175 31	40.974	40.035	—0.2	n	I
622	h 5252	21 6	136 25	135 35	175 31	39.926	39.014	—1.0	n	A
623	H. V. E.	21 8	335 35	335 40	175 44	53.967	24.837	—0.5	n	III
624	Σ 2781	21 10	344 20	345 10	175 31	40.963	40.042	—0.1	n	A
625	β 271	21 13	224 15	229 42	355 42	40.870	40.104	—0.1	n	A
626	...	...	225 40	228 20	355 42	40.802	40.192	—0.2	p	A
627	Σ 2787	21 16	194 45	195 0	175 30	42.783	36.152	—0.8	n	III
628	β 272	21 18	250 50	250 45	355 30	40.618	39.368	—0.8	p	III
629	H. A. H.	21 19	318 55	319 40	175 42	41.163	38.794	—1.2	n	III
630	...	...	319 50	317 35	175 42	41.212	38.800	—1.1	p	III

Number.	Position Angle.		Distance.		Magnitudes.		Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.					
	°	°	″	″					
601	134.2	134.2	16.56	16.55	...		80.442	E	
602	49.8	48.1	23.05	23.17	7.5	9.0	80.560	E	
603	267.1	267.4	17.93	17.93	...		79.713	S	
604	266.8	...	17.25	...	9.0	10.0	79.713	S	
605	56.0	55.0	2.73	2.77	8.5	9.0	79.790	H	
606	171.9	172.1	3.30	3.14	5.0	7.0	79.710	S	
607	240.7	239.0	22.10	22.22	6.0	6.5	80.560	E	
608	248.9	248.0	...	...	8.5	9.0	79.790	H	Blurry and hazy.
609	242.7	241.3	1.38	1.42	8.0	8.0	79.754	H	Poorly defined.
610	39.1	37.3	9.24	9.36	...		80.563	E	
611	239.8	240.5	2.04	2.04	10.0	10.0	79.593	S	
612	236.8	...	...	...	...		79.593	S	
613	105.0	104.7	...	...	8.0	11.0	79.754	H	Too blurred for distance.
614	102.5	102.0	1.33	1.35	8.0	10.5	79.790	H	
615	354.8	354.8	18.00	17.99	8.0	9.0	80.516	E	
616	59.8	60.3	2.87	2.89	8.0	9.0	79.683	S	
617	59.0	59.4	2.86	2.86	8.0	9.5	79.694	S	
618	58.6	...	3.01	...	...		79.694	S	
619	190.4	190.5	3.20	3.12	6.0	8.5	80.563	S	
620	190.9	191.1	2.78	2.70	5.5	7.0	80.593	S	
621	189.6	...	3.20	...	...		80.593	S	
622	320.5	320.3	3.11	3.10	...		80.563	E	
623	59.9	59.9	99.41	99.40	9.0	9.5	79.656	E	
624	169.2	169.2	3.14	3.06	8.0	8.2	80.563	S	
625	231.3	231.8	2.61	2.53	...		79.694	S	
626	231.3	231.7	2.08	2.08	6.5	9.5	79.694	S	
627	19.4	19.4	22.63	22.62	...		79.779	E	
628	255.3	255.7	4.27	4.31	8.0	12.0	79.790	H	Exceedingly difficult.
629	143.6	142.8	8.08	8.18	8.0	10.0	79.754	H	
630	143.0	143.0	8.23	8.27	...		79.754	H	

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
631	β 683	21 21	195 45	196 20	355 30	...	...	—0.6	n	III
632	β 165	21 28	175 35	175 10	355 30	40.702	39.341	—0.7	n	III
633	Σ 2809	21 31	338 0	338 35	175 42	45.016	35.923	—0.7	n	A
634	...	...	337 55	339 0	175 42	45.033	35.918	—0.9	n	I
635	Σ 2826 A,C	21 41	75 25	75 40	355 42	40.557	39.410	—0.5	p	A
636	H.A.H. A,B	...	279 0	280 55	175 30	...	...	—0.3	p	A
637	O. S. 110	21 41	353 20	354 20	175 42	40.412	39.616	—1.1	n	III
638	h 3059	21 44	69 45	69 40	175 42	43.607	36.320	—1.3	p	III
639	h 615	21 47	63 5	63 5	355 42	41.817	38.213	0.9	p	A
640	...	...	63 10	63 10	355 42	41.766	38.186	—1.1	p	III
641	Σ 2838	21 48	179 50	181 15	355 31	42.387	36.585	—1.2	n	A
642	Σ 2839 rej.	21 49	270 55	271 0	355 42	44.459	35.459	—0.6	p	III
643	...	...	270 25	270 35	355 30	44.028	34.952	—1.4	p	III
644	h 3068	21 51	282 50	282 45	355 30	42.014	38.951	—0.3	p	A
645	...	...	103 30	102 15	175 42	...	...	—1.2	p	III
646	Σ 2847	21 52	298 15	299 35	175 42	40.668	40.314	—0.8	n	A
647	...	...	296 45	295 45	175 42	40.653	40.361	—0.7	p	A
648	Σ 2848	21 52	231 45	231 30	175 42	41.432	38.570	—1.8	p	A
649	...	...	231 35	231 25	175 42	41.455	38.568	—1.6	p	I
650	O. S. 111	21 53	210 10	213 30	175 38	42.217	38.787	—0.1	n	A
651	...	...	30 45	33 10	355 42	42.183	38.773	—0.5	n	III
652	...	...	209 35	210 50	175 38	42.238	38.722	—0.2	p	A
653	...	...	29 35	31 10	355 42	42.195	38.712	—0.4	p	III
654	...	...	30 30	32 50	355 42	41.651	38.259	—0.9	n	III
655	...	...	32 35	31 55	355 42	...	...	—1.0	p	III
656	β 256	21 54	287 55	289 5	175 31	40.749	40.243	—0.3	p	A
657	S 802	21 56	61 0	60 35	175 31	40.034	38.992	—0.8	p	A
658	...	...	239 30	239 15	355 31	39.989	38.993	—0.4	p	I
659	β 475	22 6	54 20	48 20	175 42	...	...	—0.7	p	A
660	...	...	40 35	44 25	175 42	...	...	—0.6	p	III

Number.	Position Angle.		Distance.		Magnitudes.	Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.				
	°	°	″	″				
631	200.5	197.3	2.5e	...	8.5 12.0	79.790	H	Very faint; clouds, etc.
632	179.9	178.4	4.64	4.74	8.0 10.5	79.790	H	
633	162.6	162.4	31.03	30.95	...	79.691	S	
634	162.8	...	31.11	...	5.5 8.0	79.691	S	
635	79.8	79.4	3.91	3.93	8.0 9.0	79.754	H	A slightly elongated at 120°±
636	104.5	105.5	0.8e	0.82	8.0 10.0	79.771	S	Principal star white.
637	178.1	175.9	2.72	2.82	8.0 9.5	79.754	H	Faint.
638	254.0	253.7	24.87	24.91	7.0 11.0	79.754	H	Very faint.
639	67.4	67.1	12.30	12.32	...	79.754	H	Faint.
640	67.5	67.1	12.22	12.26	7.5 9.0	79.754	H	
641	185.0	185.0	19.80	19.79	...	80.560	E	Difficult on account of faintness of companion.
642	275.3	275.0	30.72	30.76	7.5 9.5	79.754	H	
643	275.0	273.3	30.97	31.21	...	79.779	E	Too faint to measure distance well.
644	287.3	287.7	10.45	10.45	8.5 11.0	79.771	S	
645	287.2	287.0	...	...	8.0 11.0	79.754	H	Too faint for distance.
646	123.2	123.3	1.21	1.13	7.0 8.0	79.691	S	
647	120.6	121.6	1.00	1.00	...	79.691	S	
648	55.9	55.5	9.77	9.79	7.0 8.0	79.735	H	
649	55.8	...	9.85	...	...	79.735	H	
650	36.2	36.3	11.71	11.63	...	79.760	S	
651	36.3	36.6	11.64	11.48	6.5 10.0	79.749	S	
652	34.6	34.7	12.00	12.00	7.5 10.0	79.760	S	Principal star white.
653	34.7	34.9	11.89	11.89	..	79.749	S	
654	36.0	35.1	11.58	11.68	...	79.754	H	
655	36.6	36.0	...	...	7.0 10.0	79 754	H	
656	113.0	113.7	1.73	1.73	5.5 7.0	80.563	S	
657	245.3	243.4	3.56	3.68	...	80.560	E	Very blurry.
658	243.8	...	3.40	...	...	80.560	E	
659	235.6	234.5	...	...	7.0 11.0	79.754	H	Too blurred for distance.
660	226.8	224.6	1.0e	...	...	79.754	H	

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
661	H n 56	22 8	110 15	111 45	355 42	40.697	39.317	0.0	p	III
662	...	...	292 15	292 35	175 34	40.174	38.782	—1.1	p	A
663	β 171	22 8	252 40	255 15	355 42	...	...	+0.1	p	III
664	O. S. 114	22 8	91 10	92 20	355 42	41.345	38.598	—0.2	p	III
665	H n 102	22 10	291 0	291 25	355 42	41.883	38.136	—1.8	n	III
666	...	...	290 35	290 25	355 42	...	...	—1.6	p	III
667	Σ 2885 rej.	22 10	95 10	94 20	355 42	43.203	36.780	—0.6	p	III
668	Σ 2892 rej. A,B	22 13	56 40	52 10	355 42	...	...	—0.4	p	III
669	... A,C	...	260 20	259 10	355 42	45.274	34.651	—0.5	p	III
670	h 962 A,B	22 14	13 35	14 50	355 42	40.920	39.086	—1.5	n	III
671	...	...	194 15	196 10	175 42	41.801	38.195	+0.2	n	III
672	...	...	13 10	11 10	355 42	...	...	—1.6	p	III
673	... A,C	...	219 15	218 40	355 42	41.451	38.578	+0.1	n	III
674	...	...	39 25	40 15	175 42	41.372	38.551	—1.4	p	III
675	Σ 2901	22 18	321 5	319 45	175 34	39.958	39.077	—0.8	n	A
676	Sh 345	22 20	119 50	121 35	175 31	41.598	41.359	—0.2	p	A
677	...	...	302 35	303 0	355 31	40.596	38.387	—0.5	p	A
678	Σ 2909	22 23	327 35	327 45	355 42	41.000	39.973	—1.2	n	A
679	...	...	327 20	327 30	355 42	40.950	39.993	—0.7	n	A
680	...	...	328 10	328 40	355 42	40.958	40.004	—0.7	n	III
681	...	...	326 40	326 20	355 42	41.020	39.987	—0.4	n	II
682	...	...	327 50	328 30	355 42	41.132	39.879	—0.8	n	I
683	...	...	147 55	148 20	175 30	40.473	39.523	—1.5	n	A
684	...	...	328 35	328 50	355 30	40.463	39.522	—1.5	n	A
685	...	...	328 25	327 40	355 42	40.485	39.530	—1.5	n	III
686	...	...	148 0	147 20	175 31	39.953	38.987	—0.7	n	A
687	Σ 2913	22 24	326 5	326 15	355 42	41.103	38.853	+0.2	n	A
688	Σ 2928	22 33	311 45	310 35	175 42	41.142	39.847	—0.3	n	VI
689	...	...	311 30	314 45	175 42	41.128	39.872	—0.3	n	VI
690	...	...	312 45	315 10	175 42	41.125	39.832	—0.3	n	A

Number.	Position Angle.		Distance.		Magnitudes.		Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.					
	°	°	″	″					
661	115.3	115.1	4.71	4.75	6.5	7.5	79.754	H	
662	116.8	115.0	4.75	4.87	7.0	9.0	79.765	E	Very windy.
663	258.3	257.9	10.e	...	8.5	12.0	79.754	H	
664	96.0	95.7	9.37	9.41	8.0	12.0	79.754	H	10 sec. ± following another 8m.
665	295.5	295.0	12.79	12.89	9.5	9.5	79.735	H	
666	294.8	294.3	...	...	...		79.735	H	
667	99.0	98.8	21.92	21.96	8.0	12.0	79.754	H	
668	58.7	58.1	10.e	...	...	12.0	79.754	H	Very faint.
669	264.0	263.7	36.25	36.29	8.0	9.0	79.754	H	
670	18.5	17.1	6.26	6.36	...		79.735	H	
671	19.5	18.7	5.48	5.58	...	11.0	79.754	H	Micrometer changed 2 rev. in reduction.
672	16.5	16.0	...	...	5.5	10.0	79.735	H	
673	223.3	222.3	9.81	9.91	5.5	11.0	79.754	H	
674	224.1	223.6	9.63	9.67	...	10.0	79.735	H	
675	144.8	144.6	3.01	3.00	9.0	9.5	79.765	E	Unsatisfactory; faint; poor definition.
676	305.2	305.7	7.64	7.64	7.0	7.0	80.563	S	Micrometer II changed 2 rev. in reduction.
677	307.3	305.5	7.54	7.66	...		80.560	E	
678	332.0	332.0	3.50	3.42	...		79.713	S	
679	331.7	331.7	3.27	3.19	...		79.746	S	
680	332.7	332.8	3.26	3.10	...		79.713	S	
681	330.8	...	3.53	...	...		79.746	S	
682	332.5	...	4.28	...	...		79.713	S	
683	332.6	331.5	3.24	3.29	4.5	4.5	79.787	H	
684	333.2	332.1	3.21	3.26	4.5	4.5	79.790	H	
685	332.3	330.6	3.26	3.36	...		79.735	H	
686	332.2	332.0	3.30	3.29	...		80.560	E	
687	330.5	330.0	7.68	7.73	8.0	9.0	79.754	H	
688	135.5	135.2	4.42	4.38	...		79.746	S	
689	137.4	137.1	4.29	4.25	...		79.749	S	
690	138.3	138.0	4.41	4.33	...		79.713	S	

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
691	...	...	312 40	313 30	175 42	41.127	39.857	—0.6	n	III
692	...	...	312 25	312 45	175 42	41.092	39.916	—0.5	n	III
693	...	...	313 30	313 55	175 42	40.115	39.827	—0.4	n	II
694	...	...	309 55	311 15	175 42	41.114	39.863	—0.2	p	VI
695	...	...	310 20	311 10	175 42	41.117	39.876	—0.3	p	VI
696	...	...	309 35	310 35	175 42	41.110	39.881	+0.2	p	A
697	...	...	309 50	310 0	175 42	41.131	39.881	+0.3	p	III
698	...	...	310 20	311 5	175 42	41.124	39.894	—0.4	p	III
699	...	...	311 10	311 10	175 42	40.111	39.907	—0.1	p	II
700	...	...	311 0	311 15	355 31	40.165	38.790	—0.4	n	A
701	...	...	312 30	312 10	175 42	40.076	38.902	+0.7	p	VI
702	...	...	313 30	313 5	175 42	40.119	38.883	+1.1	p	A
703	Σ 2940	22 38	136 15	137 0	355 42	39.881	39.101	—0.3	p	A
704	h 1811	22 43	329 55	331 20	175 42	40.793	39.179	—1.7	n	III
705	Σ 2948	22 45	179 25	179 45	175 42	39.880	39.116	—1.8	n	A
706	...	..	179 50	180 0	175 42	39.889	39.105	—2.1	p	A
707	Σ 2953	22 48	134 15	133 15	355 42	40.714	38.250	—1.7	p	A
708	O. S.	22 52	127 5	130 0	355 31	...	...	+0.3	n	A
709	...	...	125 42	128 45	355 31	40.853	40.133	+0.2	p	A
710	h 1838	22 54	82 25	81 55	175 42	39.794	39.184	—1.4	n	A
711	...	...	83 0	83 35	175 42	39.789	39.201	—1.5	p	A
712	Σ 2971	22 54	359 5	358 40	355 42	40.311	38.718	—1.0	n	A
713	...	...	182 40	182 45	179 52	40.283	38.733	—0.2	n	A
714	Σ 2970	22 56	33 0	32 55	355 42	41.149	38.811	—1.8	p	III
715	h 3174	23 4	14 55	14 25	355 42	40.788	39.214	—1.7	n	III
716	β 714	23 8	330 30	333 45	175 42	...	...	—0.8	n	VI
717	h 981	23 8	96 30	96 40	175 42	42.680	37.427	—1.7	p	III
718	β 715	23 8	250 20	255 55	355 34	40.960	40.073	—0.2	p	III
719	...	...	252 50	254 45	355 30	40.970	40.050	0.0	p	III
720	Σ 2996	23 9	102 50	102 50	355 42	40.224	38.753	—0.6	p	A

Number.	Position Angle.		Distance.		Magnitudes.		Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.					
	°	°	″	″					
691	137.4	137.2	4.33	4.17	8.5	8.7	79.713	S	
692	136.9	136.7	4.01	3.85	...		79.749	S	
693	138.0	...	4.40	...	...		79.746	S	Micrometer I changed 1 rev. in reduction.
694	134.9	135.5	4.27	4.27	...		79.746	S	
695	135.0	135.6	4.24	4.24	...		79.749	S	
696	134.4	134.9	4.19	4.19	...		79.713	S	
697	134.2	134.8	4.27	4.27	...		79.713	S	
698	135.0	135.6	4.20	4.20	...		79.749	S	
699	135.5	...	4.11	...	...		79.746	S	Micrometer I changed 1 rev. in reduction.
700	315.6	315.5	4.69	4.68	...		80.560	E	
701	136.6	134.8	4.01	4.07	...		79.746	E	
702	137.6	135.8	4.22	4.34	...		79.746	E	
703	140.9	138.8	2.66	2.78	9.0	10.0	79.752	E	
704	154.9	153.7	5.51	5.61	8.5	9.0	79.735	H	
705	3.9	3.7	2.61	2.60	...		79.752	E	
706	4.2	2.3	2.68	2.80	7.0	9.0	79.752	E	
707	138.0	136.2	8.41	8.53	8.0	11.0	79.752	E	Companion very faint.
708	133.0	132.7	...	...	...		80.563	S	
709	131.7	132.3	2.46	2.46	7.0	8.0	80.563	S	
710	266.5	266.2	2.08	2.07	...		79.752	E	The position angle is in the right quadrant.
711	267.6	265.6	2.01	2.13	10.0	11.0	79.752	E	
712	3.2	3.1	5.44	5.43	8.0	9.0	79.752	E	
713	2.8	2.7	5.29	5.28	...		79.497	E	
714	37.3	36.7	7.98	8.02	8.5	9.5	79.735	H	
715	19.0	17.4	5.37	5.47	8.5	9.0	79.735	H	
716	156.5	156.6	0.8e	0.82	7.0	11.0	79.760	S.	Perhaps an "atmospheric wing."
717	280.9	280.7	17.93	17.97	8.5	12.0	79.735	H	
718	257.6	256.9	3.03	3.03	6.0	12.0	79.765	S	
719	258.3	257.6	3.14	3.14	6.0	11.0	79.771	S	
720	107.1	105.3	5.02	5.14	8.5	9.0	79.752	E	

Number.	Double Star.	Mean R. A. 1880.	Position Circle. I.	Position Circle. II.	Assumed Zero.	Micrometer. I.	Micrometer. II.	Hour Angle.	Eyes.	Eye-piece.
		h. m.	° ′	° ′	° ′	r.	r.			
721	h 5393	23 12	299 15	302 40	355 30	43.305	37.658	—1.0	n	III
722	...	...	299 0	299 20	355 30	43.261	37.775	—0.9	p	III
723	h 5394	23 13	15 45	18 15	355 30	42.113	38.980	—0.4	n	A
724	...	...	196 0	197 15	175 30	42.122	38.955	—1.5	n	A
725	...	...	195 0	197 10	175 30	42.016	38.943	—1.6	p	A
726	Σ 3003	23 13	83 50	83 40	175 42	42.906	36.069	—0.4	p	III
727	h 3189	23 17	308 50	309 40	175 42	46.127	33.945	—1.7	n	III
728	Σ 3008	23 18	247 45	249 20	355 42	41.190	39.774	—0.1	p	VI
729	...	...	249 15	250 30	355 30	41.190	39.794	—0.6	p	VI
730	...	...	247 20	249 35	355 31	41.198	39.792	0.0	p	A
731	...	...	248 25	248 15	355 42	41.176	39.818	—0.2	p	III
732	Σ 3011	23 20	148 30	148 10	175 42	40.504	38.470	—0.3	p	A
733	H. V. E.	23 20	228 50	229 10	175 30	...	...	—0.8	p	III
734	Σ 3014	23 22	92 35	94 25	175 42	41.115	38.855	—1.6	p	III
735	h 3196	23 24	194 0	193 40	175 31	42.455	36.552	—0.1	n	A
736	...	...	196 20	196 30	175 28	42.531	...	—1.0	p	A
737	h 3197	23 24	304 0	305 10	355 30	...	...	—1.2	n	A
738	...	...	...	...	...	41.720	39.242	0.0	n	A
739	...	...	301 0	302 35	355 30	41.720	39.295	—1.1	p	A
740	...	...	300 35	303 20	355 30	...	...	—0.3	p	I
741	β 726	23 40	327 40	330 15	355 38	...	...	—0.8	n	A
742	...	...	316 15	321 35	355 30	...	...	—0.5	n	A
743	...	...	317 5	317 15	355 30	...	...	—0.4	p	A
744	H.V. E. 124	23 41	262 15	261 40	175 42	40.222	39.828	—1.5	p	III
745	Σ 3040	23 42	32 20	32 25	175 42	40.612	39.392	—1.7	...	III
746	Σ 3045	23 48	252 50	253 25	355 42	40.250	39.737	—1.5	p	III
747	Σ 3046	23 50	241 45	242 30	355 42	39.948	39.050	0.0	p	A
748	Weisse	23 54	266 15	267 40	175 42	40.249	39.718	—1.2	p	III
749	H. A. H.?	23 55	80 10	83 35	355 42	40.268	39.738	—1.4	p	III
750	Σ 3052	23 57	182 25	182 30	175 42	44.453	34.501	—0.7	n	A

Number.	Position Angle.		Distance.		Magnitudes.	Epoch 1800+	Observer.	Notes.
	Obs.	Cor.	Obs.	Cor.				
	°	°	″	″				
721	305.5	305.1	19.27	19.11	8.0 10.0	79.771	S	
722	303.7	304.2	18.72	18.72	...	79.771	S	
723	21.5	20.9	10.69	10.61	6.0 10.5	79.773	S	Principal star white.
724	21.1	21.3	10.81	10.73	...	79.790	S	
725	20.6	20.8	10.49	10.49	5.0 10.5	79.790	S	
726	268.0	266.3	23.33	23.57	...	79.752	E	
727	133.6	133.2	41.57	41.67	...	79.735	H	
728	252.8	253.3	4.83	4.83	...	76.749	S	
729	254.4	254.8	4.76	4.76	6.5 7.5	79.790	S	
730	253.0	253.4	4.80	4.80	7.0 8.0	80.563	S	
731	252.6	253.1	4.63	4.63	7.0 8.0	79.749	S	
732	332.6	330.8	6.94	7.06	...	79.752	E	
733	53.5	51.7	7.e	...	...	79.902	E	
734	277.8	277.7	7.71	7.75	7.5 9.5	79.735	H	
735	18.3	18.3	20.15	20.14	9.0 10.0	80.893	E	Definition very poor.
736	21.0	19.3	...	...	...	80.516	E	Became too faint for distance.
737	309.1	308.8	...	...	8.0 9.0	79.790	S	
738	...	...	8.46	8.38	9.0 10.0	79.842	S	
739	306.3	306.9	8.28	8.28	...	79.790	S	Clouds.
740	306.5	...	...	...	...	79.809	S	Too faint with power A.
741	333.3	333.7	0.8e	0.82	8.0 10.5	79.760	S	Probably an error of 10° in pos. angle.
742	323.4	323.6	0.7e	0.72	8.0 10.0	79.773	S	
743	321.7	322.6	...	...	...	79.773	S	
744	86.3	86.1	1.34	1.38	8.5 9.0	79.735	H	
745	216.7	216.0	4.16	4.20	8.5 8.5	79.735	H	
746	257.4	257.1	1.75	1.79	8.0 9.0	79.735	H	
747	246.4	244.5	3.06	3.18	...	79.746	E	
748	91.3	91.0	1.81	1.85	8.5 9.0	79.735	H	
749	86.2	85.9	1.81	1.85	8.5 9.0	79.735	H	Probably same as preceding.
750	6.8	6.8	33.96	33.95	...	79.752	E	

MEAN RESULTS.

1879-80.

Number.	Double Star.	Name.	Mean R. A. 1880.	Mean Dec. 1880.	Position Angle.	Distance.	Weights.	Magnitudes.	Epoch 1800+
			h. m. s.	° ′	°	″			
1	Σ 3063	L. 47294	0 1 28	— 5 13	220.6	1.78	3.2	8.2 9.2	79.71
2	Σ 3064 rej.	P. M. 2873	0 2 10	+39 26	353.9	23.78	1.1	7.0 10.0	79.61
3	β 486	Ceti 31	0 8 19	— 8 27	6.3	3.05	2.2	5.8 10.5	79.76
4	Σ 15	L. 204	0 9 44	— 6 16	196.0	5.26	1.1	9.0 10.5	79.66
5	h 1947	L. 209	0 10 3	+42 56	76.4	9.07	1.1	7.0 9.0	79.61
6	Weisse	W 0 264	0 11 10	+35 11	106.4	5.35	1.1	8.0 8.7	79.61
7	Σ 23	W 0 164	0 11 20	— 0 21	349.2	8.11	1.1	...	79.75
8	β 393	L. 291	0 12 12	—21 48	11.4	0.69	1.1	6.0 8.0	79.75
9	β 256	Anon.	0 13 9	—14 29	250.3	2.41	1.1	8.5 9.5	79.77
10	H v 85	L. 335	0 13 44	+37 34	15.8	62.80	1.1	7.5 9.0	79.70
11	Σ 30	Cassiopeæ 49	0 20 43	+49 19	299.1	19.20	2.2	6.8 8.5	79.61
12	Σ 31	P. M. 26	0 21 30	+40 45	57.1	5.56	1.1	8.5 9.0	79.61
13	h 1968	L. 593	0 21 33	—17 4	71.9	7.46	2.2	7.0 10.8	79.87
14	h 1980	Anon.	0 25 25	—11 56	122.8	6.03	1.1	...	79.78
15	h 3377	Anon.	0 27	—26.45	56.5	18.55	1.1	...	79.90
16	h 3379	L. 937	0 30 47	—28 5	231.3	14.49	3.3	7.0 9.5	79.76
17	h 1044	Anon.	0 33 46	+43 5	318.8	21.90	2.2	8.5 8.7	79.61
18	Σ 67	L. 1432	0 45 52	+ 9 57	4.4	2.00	1.1	8.5 9.5	79.70
19	h 2000	Anon.	0 46 6	—15 30	114.2	17.80	1.1	...	79.90
20	β 734	Lac. 238	0 46 47	—24 40	345.6	10.75	1.1	5.5 9.5	79.69
21	Σ 70	P. M. 68	0 46 52	+52 2	244.2	8.13	2.2	...	79.78
22	W. C. 457,8	Lac. 241	0 47 19	—25 26	12.7	5.50	1.1	7.0 9.0	79.69
23	H. A. H. 1	O. Arg. 509	0 49 52	—17 1	105.1	1.72	2.2	8.5 8.5	79.78
24	Σ 76	P. M. 73	0 50 19	+10 1	199.3	3.38	1.1	9.0 13.0	79.74
25	Σ 82	L. 1737	0 54 26	+ 8 50	306.8	2.40	1.1	8.0 9.0	79.66
26	h 2010	L. 1774	0 55 53	+47 3	270.8	10.03	1.1	8.0 9.5	79.61
27	h 1064	39 Andromedæ	0 56 10	+40 42	3.4	15.	1.0	6.0 13.0	79.61
28	Σ 86	L. 1885	0 58 43	— 6 7	160.0	12.85	4.3	...	79.87
29	h 10 A,B	Anon.	0 58 47	+12 11	313.0	4.76	2.1	8.2 9.8	79.66
30	... A,C	...	...	...	55.2	8.80	2.1	... 9.5	79.66

Number.	Double Star.	Name.	Mean R. A. 1880.	Mean Dec. 1880.	Position Angle.	Distance.	Weights.	Magnitudes.	Epoch 1800+
			h. m. s.	° ′	°	″			
31	h 10 B,C	Anon.	0 58 47	+12 11	263.1	10.79	2.1	...	79.66
32	H iv 66	Cassiopeæ 106	0 59 59	+52 51	75.2	22.83	1.1	...	79.78
33	Σ 89 rej.	O. Arg. 1090	1 0 13	+79 42	14.8	16.14	1.1	8.5 9.0	79.75
34	h 633	Schj. 379	1 3 3	— 3 32	143.4	9.39	1.1	10.0 11.0	79.74
35	Σ 96	Piazzi o 312	1 4 51	+64 22	279.5	1.41	1.1	...	79.78
36	Σ 101	L. 2204	1 7 54	— 8 15	340.6	20.94	2.2	7.0 9.8	79.78
37	H.V. E. A,B	Anon.	1 9	+53 7	271.8	...	1.	...	79.78
38	... A,C	...	...	...	114.5	...	1.	...	79.78
39	Σ 103	Lamont V 191	1 8 38	— 1 59	243.6	5.47	1.1	8.0 11.0	79.74
40	Σ 106	W i 124	1 10 14	— 7 47	307.9	4.61	1.1	9.0 9.0	79.74
41	Σ 102 A,B	L. 2283	1 10 40	+48 23	307.8	0.52	2.½	7.0 8.0	79.61
42	...½(A+B),C	...	...	...	224.7	10.08	2.2	7.0 8.5	79.61
43	...½(A+B),D	...	...	...	63.0	28.07	1.1	7.0 10.0	79.61
44	Σ 105	P. M. 100	1 10 53	+65 32	182.3	2.90	1.1	...	79.78
45	Σ 112	O. Arg. 1406	1 13 40	+45 42	327.2	22.80	1.1	...	79.78
46	Σ 113	42 Ceti	1 13 40	— 1 8	347.8	1.40	2.2	6.5 7.8	79.78
47	h 2036	L. 2416	1 14 4	—16 26	24.1	1.66	5.3	7.5 8.0	79.79
48	Σ 114	Anon.	1 15 4	+72 13	353.4	3.83	2.1	...	79.75
49	β 4	L. 2483	1 16 34	+10 44	119.1	0.52	1.½	7.0 7.0	79.66
50	Secchi	Lac. 381	1 17 52	—24 59	76.5	2.62	1.1	7.0 9.0	79.77
51	Σ 120	Ceti 202	1 18 58	— 6 34	278.9	7.46	1.1	7.0 11.0	79.73
52	Σ 122	L. 2632	1 20 42	+ 2 55	327.4	6.12	1.1	7.8 9.0	79.66
53	Σ 118	P. M. 113	1 20 47	+82 44	69.8	11.68	2.2	8.5 9.5	79.77
54	Σ 125	L. 2635	1 20 50	— 0 46	350.6	31.21	1.1	8.0 10.0	79.68
55	Σ 127	P. M. 121	1 24 59	+78 32	186.0	24.67	1.1	8.2 9.0	79.75
56	h 1085	Anon.	1 30 25	+63 6	296.0	3.92	2.2	8.5 9.0	79.77
57	h 17	Anon.	1 32 46	+11 35	280.8	7.81	1.1	9.0 10.0	79.66
58	h 641	L. 3053	1 33 33	— 3 8	129.5	5.57	2.2	8.5 11.0	79.76
59	Σ 146	W i 600	1 34 57	+ 9 30	305.6	24.05	2.1	8.0 8.0	79.66
60	Σ 147	χ′ Ceti	1 35 49	—11 55	87.2	3.70	2.2	6.0 7.0	79.72

Number.	Double Star.	Name.	Mean R. A. 1880.	Mean Dec. 1880.	Position Angle.	Distance.	Weights.	Magnitudes.	Epoch 1800+
			h. m. s.	° ′	°	″			
61	Σ 160	Anon.	1 40 16	— 3 0	269.4	9.66	1.1	9.0 10.0	79.77
62	Σ 166	W i 720	1 41 48	— 3 56	0.4	8.00	1.1	8.5 9.0	79.77
63	β	L. 3289	1 41 50	— 1 33	350.3	1.4	3.0	8.5 9.5	79.79
64	H. V. E.	Anon.	1 42	+45 29	146.2	5.73	1.1	8.0 8.5	79.78
65	h 644	L. 3303	1 42 22	+ 7 5	277.5	17.03	1.1	7.5 13.0	79.66
66	Σ 171	P. M. 157	1 42 40	— 2 1	159.3	29.98	1.1	8.5 8.5	79.77
67	Σ 173 rej.	L. 3344	1 43 38	+13 45	203.4	22.48	1.1	8.5 10.0	79.66
68	Σ 170	P. M. 174	1 44 24	+75 38	244.6	3.37	2.2	7.0 8.5	79.75
69	Σ 177	W i 783	1 45 13	+ 4 21	120.3	34.54	1.1	9.0 9.5	79.74
70	Σ 3113	L. 3406	1 46 4	+44 2	272.2	1.19	1.1	8.5 8.5	79.61
71	β 183	L. 3487	1 47 21	—17 20	226.7	2.42	1.1	8.0 9.5	79.77
72	Σ 199	O. Arg. 2289	1 55 58	+67 6	20.4	36.27	1.1	...	79.78
73	Σ 206	W i 982	1 56 27	+10 47	133.6	31.38	1.1	8.0 9.0	79.66
74	Σ 214	O. Arg. 1067	2 1 2	+15 1	189.2	4.96	1.1	8.0 9.5	79.66
75	Σ 222	59 Andromedæ	2 3 36	+38 28	34.2	16.94	1.1	...	79.78
76	Σ 231	66 Ceti	2 6 39	— 2 57	230.0	15.88	1.1	6.0 8.0	79.68
77	Σ 237	Schj. 654	2 9 17	+10 13	237.4	14.46	1.1	8.0 8.3	79.66
78	Σ 233	P. M. 208	2 9 26	+75 49	273.8	2.6	1.0	...	79.77
79	Σ 238	P. M. 212	2 9 56	+36 56	354.7	11.16	1.1	...	79.78
80	Σ 246	L. 4239	2 11 28	+33 56	122.1	10.45	1.1	...	79.78
81	Σ 247 rej.	DM 320	2 12 7	+ 3 37	32.2	7.37	1.1	10.0 10.5	79.66
82	β 437	L. 4291	2 12 26	+ 3 39	29.6	5.81	1.1	8.0 12.0	79.66
83	Σ 248	W ii 278	2 13 31	+42 14	155.1	1.93	1.1	8.5 9.0	79.61
84	Σ 250	W ii 287	2 13 57	+36 52	135.4	2.73	1.1	8.0 9.0	79.61
85	Σ 251	P. M. 224	2 14 21	+38 50	265.2	2.24	1.1	8.0 9.0	79.61
86	Σ 261	P. M. 232	2 17 55	+10 57	67.3	2.99	2.2	8.5 9.0	79.66
87	Σ 271	L. 4608	2 23 38	+24 42	181.6	12.06	1.1	...	79.78
88	Σ 276	P. M. 413	2 26 20	+ 5 48	254.3	2.14	1.1	8.5 8.5	79.66
89	Σ 280	L. 4773	2 28 9	— 6 10	346.7	3.52	2.2	8.0 8.0	79.70
90	h 3506	Lac. 783	2 28 35	—28 46	242.4	10.65	1.1	4.5 7.5	79.79

Number.	Double Star.	Name.	Mean R. A. 1880.	Mean Dec. 1880.	Position Angle.	Distance.	Weights.	Magnitudes.	Epoch 1800+
			h. m. s.	° ′	°	″			
91	Σ 282	O. Arg. 2973	2 31 8	+65 8	292.4	7.24	2.2	...	79.78
92	Σ 287	L. 4903	2 32 24	+14 20	71.5	6.32	1.1	...	79.66
93	h 1123	W ii 778	2 34 15	+42 17	247.2	20.21	2.2	8.0 8.2	79.61
94	0 Σ 44	W ii 785	2 34 23	+42 12	51.2	1.56	1.1	8.0 9.0	79.61
95	0 Σ 45	W ii 573	2 34 40	+ 4 21	294.3	2.03	1.1	6.5 10.0	79.74
96	h 2155	L. 4954	2 35 1	+42 18	320.5	17.19	1.1	8.0 9.5	79.61
97	Σ 295	84 Ceti	2 35 5	— 1 12	323.2	4.44	3.2	6.0 11.0	79.75
98	Σ 299	γ Ceti	2 37 5	+ 2 44	287.2	3.19	1.1	4.0 10.0	79.74
99	Σ 303	W ii 644	2 38 35	— 2 28	180.5	5.49	2.2	8.0 9.0	79.73
100	Br. 394	Lac. 850	2 38 54	—26 0	187.1	11.71	1.1	...	79.90
101	Σ 308	Anon.	2 41 40	—10 22	158.1	12.37	1.1	...	79.78
102	β 10	L. 5276	2 44 23	— 5 29	100.1	2.56	1.1	8.0 12.0	79.68
103	Σ 330	Ceti 478	2 51 4	— 1 3	191.5	8.71	2.2	7.5 9.5	79.73
104	Σ 334	L. 5523	2 53 1	+ 6 10	315.8	1.5	1.0	...	79.90
105	Σ 341	L. 5652	2 56 57	— 2 33	227.1	8.59	3.2	8.0 10.5	79.69
106	Σ 355	W ii 1056	3 0 54	+ 7 56	145.7	2.54	1.1	8.5 9.0	79.66
107	Σ 358	W ii 1091	3 2 45	— 4 9	350.8	15.	1.0	9.0 12.0	79.66
108	h 3554	L. 5959	3 6 42	— 3 22	347.6	20.04	1.1	8.0 11.0	79.66
109	β 84	W iii 147	3 10 5	— 6 22	30.6	0.74	1.2	6.0 8.0	79.78
110	Σ 371	L. 6023	3 10 23	+46 35	82.0	2.85	1.1	8.0 10.0	79.61
111	Jacob	τ^4 Eridani	3 14 11	—22 12	280.0	4.9	1.0	...	79.90
112	Schj. 1001	L. 6327	3 19 19	— 1 35	183.4	17.20	1.1	8.0 9.0	79.66
113	Σ 393	L. 6352	3 20 11	— 1 27	258.2	16.09	1.1	8.0 10.5	79.66
114	Σ 394	L. 6367	3 21 6	+20 3	162.7	6.79	1.1	7.0 8.0	79.66
115	H iv 89	L. 6436	3 23 33	+19 42	147.3	20.40	1.1	8.0 9.5	79.66
116	Σ 407	W iii 408	3 24 16	—11 33	44.5	3.14	1.1	8.0 10.0	79.74
117	Σ 408	W iii 412	3 24 42	— 4 41	337.4	1.30	1.1	...	79.79
118	Σ 414	L. 6568	3 27 33	+19 24	182.8	7.42	1.1	7.5 7.5	79.66
119	Σ 416 rej.	DM 556	3 28 2	+19 25	52.7	25.89	1.1	8.5 9.5	79.66
120	Σ 438	L. 6831	3 36 26	+22 21	240.3	1.80	1.1	8.0 8.8	79.66

Number.	Double Star.	Name.	Mean R. A. 1880.	Mean Dec. 1880.	Position Angle.	Distance.	Weights.	Magnitudes.	Epoch +1880
			h. m. s.	° ′	°	″			
121	Σ 439	P. M. 370	3 37 3	+31 47	37.3	23.38	1.1	8.0 10.0	79.61
122	Σ 442	DM 538	3 37 55	+22 21	263.1	2.	1.0	9.0 10.0	79.66
123	H. A H.	Anon.	3 38	+22 21	173.3	28.27	1.1	8.0 12.0	79.66
124	Σ 444	15 Pleiadum	3 38 43	+22 46	335.1	2.80	1.1	7.5 10.5	79.66
125	Σ 451 rej.	L. 6986	3 40 6	−13 42	321.5	20.06	1.1	8.0 8.5	79.74
126	Σ 456 rej.	DM 664	3 42 9	+ 1 15	118.9	21.80	1.1	8.5 9.5	79.66
127	β 401	L. 7109	3 44 10	− 1 53	255.8	4.00	1.1	6.0 10.0	79.77
128	Σ 468	Anon.	3 48 7	− 2 10	97.1	20.80	1.1	8.5 9.5	79.66
129	Σ 478	W iii 1016	3 53 11	+11 12	136.2	9.82	1.1	8.0 9.0	79.74
130	Σ 476	L. 7368	3 53 36	+38 20	285.0	20.11	1.1	7.5 8.5	79.61
131	Σ 487 A,B	W iii 1054	3 55 12	−10 47	8.5	12.33	1.1	...	79.74
132	... A,C	...	...	...	233.6	22.	1.0	...	79.74
133	Σ 482	W iii 1167	3 55 48	+21 48	123.3	13.20	1.1	8.0 9.5	79.66
134	Σ 483	L. 7439	3 56 2	+39 11	172.6	2.03	1.1	8.0 9.5	79.61
135	Σ 493	W iii 1146	4 0 22	+ 5 22	92.9	1.67	2.2	8.0 8.5	79.66
136	Σ 515	L. 7879	4 7 8	+ 2 34	42.6	3.18	2.1	8.0 8.5	79.66
137	Σ 512	W iv 79	4 7 10	+45 6	224.2	5.16	3.3	7.5 7.5	79.61
138	Σ 516	L. 8027	4 8 41	−10 33	149.4	6.13	1.1	6.0 10.0	79.73
139	Σ 518 A,B	40 Eridani	4 9 46	− 7 50	105.6	82.42	1.1	4.0 8.5	79.76
140	... A,D	...	...	...	132.9	35.78	1.2	... 12.8	79.77
141	... B,C	...	...	...	120.0	3.29	1.1	... 10.5	79.52
142	Σ525rej. A,B	W iv 217	4 12 34	− 2 59	243.6	44.05	1.1	8.0 9.0	79.66
143	... B,C	...	...	...	168.3	7.29	1.1	9.0 9.5	79.66
144	Σ 527	L. 8107	4 13 13	− 7 43	190.7	5.90	1.1	7.0 10.0	79.84
145	Σ 529	L. 8141	4 15 28	+28 7	14.6	4.66	1.1	8.0 11.0	79.75
146	Σ 536	L. 8222	4 16 13	− 4 58	159.0	1.77	1.1	...	79.77
147	O. S.	L. 8521	4 23 55	−25 28	346.8	6.77	1.1	...	79.90
148	Σ 562	Tauri 278	4 27 35	+22 27	268.0	2.20	1.1	7.5 11.0	79.66
149	Σ 564	Anon.	4 27 42	−12 23	343.0	3.65	1.1	...	79.79
150	β	46 Eridani	4 28 4	− 7 0	48.0	1.3	1.0	6.0 9.0	79.78

Number.	Double Star.	Name.	Mean R. A.	Mean Dec. 1880.	Position Angle.	Distance.	Weights.	Magnitudes.	Epoch 1800+
			h. m. s.	° ′	°	″			
151	Σ 609	DM 865	4 43 40	+ 0 57	74.0	2.54	1.1	...	79.77
152	Σ 607	DM 744	4 45 48	+25 18	249.5	14.25	1.1	9.0 11.0	79.66
153	0 Σ 91	L. 9268	4 49 57	+ 2 59	237.7	0.73	1.1	8.0 8.5	79.75
154	β 314	Leporis 3	4 53 39	−16 34	331.9	0.5	1.0	...	79.78
155	Σ 651	W v 38	5 4 14	− 7 13	54.2	17.17	1.1	...	79.79
156	Σ 661	κ Leporis	5 7 41	−13 5	359.6	2.52	1.1	...	79.66
157	β 555 B,C	Rigel	5 8 46	− 8 20	158.7	0.42	1.½	6.0 6.5	79.76
158	Σ 668 A,½(B+C)	Rigel	5 8 46	− 8 20	200.7	9.55	5.5	1.0 ...	79.70
159	Σ 667	W v 165	5 8 52	− 7 13	311.4	4.08	1.1	7.0 10.0	79.74
160	h 3750	L. 10063	5 15 20	−21 22	279.7	3.04	1.1	4.5 7.0	79.78
161	Σ 701	Orionis 88	5 17 33	− 8 32	144.0	5.75	1.1	...	79.74
162	Σ 702	L. 10134	5 18 21	+ 2 15	76.3	8.76	1.1	8.0 9.0	79.74
163	Σ 706	Anon.	5 18 38	+30 14	39.7	3.82	1.1	8.0 10.0	79.75
164	H vi 68	L. 10165	5 19 0	− 2 57	279.7	120.	1.0	...	79.82
165	Σ 712	L. 10195	5 20 15	+ 2 50	53.6	3.03	2.2	...	79.78
166	β 320	β Leporis	5 23 6	−20 51	286.3	2.57	2.1	2.8 7.8	79.77
167	Σ 743	P. M. 602	5 28 47	− 4 28	278.4	2.21	1.1	...	79.77
168	Σ 741	L. 10512	5 28 48	− 0 12	283.9	10.22	1.1	...	79.79
169	H.V. E.	Anon.	5 29 2	+ 7 11	242.9	43.50	1.1	...	79.82
170	Σ 748 A,B	θ^1 Orionis	5 29 23	− 5 28	59.1	13.02	1.1	5.5 7.0	79.66
171	... A,C	...	...	...	311.5	12.86	1.1	... 7.0	79.66
172	... B,D	...	...	...	298.9	19.15	1.1	... 8.0	79.66
173	... C,c	...	...	...	349.0	3.53	2.1	... 11.0	79.74
174	... C,D	...	...	...	31.4	8.35	1.1	...	79.66
175	Σ 752 A,B	ε Orionis	5 29 34	− 5 59	142.2	11.22	1.1	...	79.66
176	H. C. Zones	Anon.	5 30	− 1 0	39.7	18.	1.0	...	79.82
177	Σ 754	Orionis 158	5 30 44	− 6 8	286.3	5.40	1.1	...	79.74
178	Σ 755	...	5 31 51	+23 13	315.7	5.85	1.1	8.5 9.0	79.66
179	Σ 759	Anon.	5 31 47	+17 41	322.9	30.09	1.1	8.0 8.5	79.66
180	Σ 763	P. M. 614	5 32 40	+10 12	318.6	5.65	1.1	8.0 9.0	79.66

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			h. m. s.	° ′	°	″			
181	Σ 774	ζ Orionis	5 34 42	— 2 0	152.6	2.60	2.2	3.8 5.2	79.73
182	Σ 790	Orionis 187	5 40 6	— 4 19	89.0	7.42	1.1	...	79.79
183	Σ 839	Anon.	5 58 52	— 2 43	285.3	5.06	2.2	8.0 8.2	79.76
184	Σ 871	W vi 93	6 5 27	— 0 44	304.9	7.38	1.1	...	79.79
185	H iv 81	ν^1 Can. Maj.	6 31 8	—18 34	261.1	17.47	1.1	...	79.79
186	A. G. C. 1	Sirius	6 39 52	—16 33	46.5	10.29	2.1	1.0 7.0	79.75
187	Σ 1011	Can. Maj. 124	6 55 24	—15 9	297.3	4.69	1.1	9.0 9.5	79.74
188	h 750	Anon.	7 0 13	— 2 7	91.4	8.63	1.1	...	79.77
189	h 2362	Anon.	7 1 51	+ 3 33	187.2	28.63	1.1	...	79.82
190	Σ 1034	W vii 37	7 3 35	— 8 7	15.6	2.70	1.1	...	79.77
191	Σ 1045	L. 14013	7 6 42	— 2 58	228.3	5.82	1.1	...	79.79
192	h 3938	L. 14105	7 8 43	—22 42	248.8	20.11	1.1	...	79.77
193	Σ 1056	L. 14107	7 9 30	— 1 39	300.3	3.8	1.0	...	79.82
194	Σ 1103	L. 14601	7 24 11	+ 5 30	243.0	4.44	1.1	...	79.77
195	β 201	L. 14945	7 33 41	—20 0	330.8	2.79	1.1	7.0 8.0	80.16
196	Σ 1124	W vii 959	7 33 50	+22 5	324.7	19.49	1.1	...	79.82
197	Σ 1146	5 Puppis	7 42 20	—11 54	14.1	3.20	2.2	...	79.77
198	0 Σ 182	L. 15349	7 46 24	+ 3 42	34.7	1.39	1.1	...	79.77
199	β 334	L. 15933	8 2 3	—21 42	354.2	2.4	1.0	...	80.18
200	H. A. H. 9	W. M.Z.(221)28	8 12 26	—26 54	293.6	3.26	1.1	8.5 9.0	80.22
201	Σ 1216	L. 16375	8 15 15	— 1 13	166.4	0.62	1.½	...	80.22
202	Σ 1260	L. 17455	8 34 59	—11 45	299.8	5.08	1.1	...	80.22
203	β 587	15 Hydræ	8 45 41	— 6 44	152.2	0.42	1.½	...	80.22
204	Σ 1295	17 Hydræ	8 49 37	— 7 31	357.9	4.14	1.1	7.0 7.5	80.23
205	β 210	L. 17696	8 51 18	—16 58	181.0	2.54	2.2	6.5 6.5	79.25
206	Σ 1308	L. 17927	8 58 59	— 3 31	84.0	10.69	1.1	...	80.22
207	h 4172	Anon.	9 1 5	—24 55	217.4	7.03	2.1	7.5 8.5	80.22
208	W. M. C. Z.	Lac. 3873	9 25 26	—28 14	239.0	0.62	1.½	7.0 8.0	80.22
209	β 217	W. M. Z. (248)9	10 1 16	—24 8	277.6	2.08	2.2	...	80.22
210	h 4305	Anon.	10 14 54	—23 2	214.5	17.20	1.1	7.5 8.8	80.22

Number.	Double Star.	Name.	Mean R. A. 1880.	Mean Dec. 1880.	Position Angle.	Distance.	Weights.	Magnitudes.	Epoch 1880+
			h. m. s.	° ′	°	″			
211	β	Lamont XII 701	10 16 26	−13 4	101.4	1.0	1.0	8.5 11.0	80.24
212	Σ 1440	L. 20356	10 23 46	− 3 18	347.9	15.43	1.1	7.0 9.0	80.24
213	h 4337	O. Arg. 10765	10 31 45	−18 44	72.0	10.31	1.1	8.5 10.0	80.22
214	Σ 1474	L. 20799	10 41 43	−14 38	17.7	6.86	1.1	...	80.22
215	Σ 1500	L. 21116	10 53 55	− 2 50	313.8	1.42	2.2	8.0 8.0	80.22
216	O. S.	O. Arg. 11040	10 54 18	−25 24	335.1	6.30	1.1	...	80.22
217	H i 77	Anon.	10 56 12	−15 8	15.3	2.91	1.1	...	80.22
218	Σ 1506	L. 21238	10 58 38	− 3 34	215.0	10.70	2.2	7.0 9.0	80.24
219	β 220	Crateris 22	11 6 34	−17 51	323.8	0.87	1.1	6.0 7.0	80.22
220	Σ 1529	L. 21586	11 13 17	− 1 0	251.0	9.65	1.1	6.5 7.5	80.22
221	β 26	L. 21697	11 17 42	− 9 46	65.4	2.62	1.1	...	80.33
222	S 627 A, ½(B+C)	Anon.	11 23 15	−16 41	331.6	28.30	1.1	6.0 ...	80.29
223	... B, C	...	...	...	224.9	0.82	1.½	8.0 9.0	80.29
224	Jacob 143	Hydræ 271	11 23 41	−23 47	78.2	8.15	1.1	...	80.37
225	H iii 96	17 Crateris	11 26 19	−28 36	28.8	9.04	2.2	...	80.22
226	β 456	L. 22020	11 30 45	−11 41	255.2	0.72	1.½	9.5 9.5	80.24
227	h 4478	β Hydræ	11 46 51	−33 14	345.1	1.88	2.2	4.5 6.0	80.23
228	h 4479	O. Arg. 11733	11 47 16	−23 55	93.4	6.87	1.1	8.0 9.5	80.36
229	h 4481	L. 22513	11 51 12	−21 52	196.9	3.2	1.0	...	80.37
230	Σ 1593	W xi 959	11 57 23	− 1 47	18.7	1.34	1.1	8.0 8.0	80.33
231	h 4496	Anon.	12 0 1	−18 14	27.8	12.16	1.1	8.0 9.0	80.36
232	Σ 1605	W xii 28	12 4 19	− 1 34	277.8	23.85	1.1	7.8 8.8	80.29
233	Σ 3080	W xii 50	12 5 24	−13 2	199.6	4.6	1.0	8.0 9.5	80.35
234	Σ 1635	L. 23131	12 14 57	−10 48	173.5	13.37	1.1	7.5 8.5	80.35
235	O. S. 71	O. Arg. 12151	12 19 22	−27 45	330.0	13.46	1.1	8.0 10.5	80.33
236	Sh 145	δ Corvi	12 23 40	−15 51	214.0	24.43	1.1	4.0 9.0	80.36
237	Σ 1649	W xii 401	12 25 24	−10 24	194.9	15.40	1.1	...	80.22
238	Σ 1664	L. 23613	12 32 7	−10 51	249.2	21.34	1.1	7.0 8.5	80.32
239	β 607	Schj. 4572	12 35 2	− 0 48	314.5	1.08	2.2	9.0 11.0	80.34
240	Σ 1670	γ Virginis	12 35 35	− 0 48	156.9	5.13	6.6	...	80.32

Number.	Double Star.	Name.	Mean R. A. 1880.	Mean Dec. 1880.	Position Angle.	Distance.	Weights.	Magnitudes.	Epoch 1800+
			h. m. s.	° ′	°	″			
241	O. S.	Anon.	12 40 2	−21 47	272.4	1.5	1.0	9.0 9.5	79.36
242	Σ 1690	W xii 831	12 50 4	− 4 13	146.6	5.93	2.1	7.5 9.0	80.32
243	0 Σ 256	L. 24098	12 50 17	− 0 18	245.6	0.81	1.1	...	80.37
244	O. S. 73	Anon.	12 52	−12 29	65.1	2.03	3.3	7.8 8.0	80.30
245	Σ 1704	44 Virginis	12 53 29	− 3 10	52.9	20.59	1.1	6.0 10.0	80.36
246	A. G. C. 5	46 Virginis	12 54 25	− 2 43	150.5	1.27	3.2	6.0 8.0	80.38
247	β	48 Virginis	12 57 43	− 3 1	227.3	0.6	1.0	...	80.35
248	β 609	W xiii 27	13 4 31	− 4 18	356.2	0.82	2.½	7.0 10.0	80.34
249	β 221	L. 24532	13 6 54	−14 49	46.4	1.52	2.2	8.0 10.0	80.36
250	H ii 45	54 Virginis	13 7 3	−18 11	33.1	5.26	4.3	...	80.33
251	β 342	O. Arg. 12741	13 8 49	−18 17	33.8	3.96	4.4	...	80.38
252	O. S. 74	Anon.	13 9	−23 35	333.5	12.2	1.0	8.0 10.0	80.36
253	O. S.	Anon.	13 15	+30 58	175.1	0.42	1.½	7.5 7.5	79.30
254	Σ 1742	W xiii 267	13 18 12	+ 2 2	350.5	1.20	3.3	7.5 8.0	80.31
255	O. S. 76	O. Arg. 12867	13 19 43	−22 37	354.2	1.56	1.1	8.0 9.0	80.35
256	h 2653	Anon.	13 22 46	−17 25	237.2	20.79	1.1	8.0 12.0	80.34
257	β 114	W xiii 438	13 28 0	− 8 0	137.0	1.50	4.2	7.9 8.0	80.33
258	H n 69	f Hydræ	13 30 9	−25 53	192.0	10.04	2.2	6.4 7.6	80.38
259	O. S.	Anon.	13 31	−14 10	263.1	4.58	1.1	8.5 11.0	80.42
260	Σ 1763	81 Virginis	13 31 18	− 7 16	41.2	2.93	2.2	7.0 8.0	80.37
261	h 4604	W.M.C.Z. (25)3	13 34 4	−27 38	279.0	15.51	3.3	8.3 10.5	80.38
262	h 2671	L. 25285	13 36 37	−24 22	70.0	27.84	2.2	9.0 9.8	80.38
263	h 2674	Anon.	13 38 27	−19 18	5.2	22.93	1.1	8.0 9.0	80.42
264	Σ 3081	W xiii 645	13 38 47	−11 15	67.8	2.08	2.2	8.0 8.5	80.33
265	β A,B	86 Virginis	13 39 33	−11 49	299.9	1.63	3.2	...	80.42
266	h 4617	O. Arg. 13176	13 43 54	−29 17	259.7	1.27	1.1	8.0 10.0	80.34
267	h 4637	Anon.	13 50 45	−11 58	137.7	12.98	2.2	9.0 9.5	80.37
268	β 344	O. Arg. 12385	13 52 23	−24 58	124.4	3.31	2.2	8.0 9.0	80.33
269	h 4650	W. T. Z. (118)8	14 0 5	−28 37	60.5	10.	1.0	9.0 12.0	80.35
270	h 4661	O. Arg. 13452	14 5 8	−28 20	49.0	2.	2.0	...	80.38

Number.	Double Star.	Name.	Mean R. A. 1880.	Mean Dec. 1880.	Position Angle.	Distance.	Weights.	Magnitudes.		Epoch 1800+
			h. m. s.	° ′	°	″				
271	h 4664	O. Arg. 13477	14 7 33	−28 41	14.8	17.74	3.3	8.2	9.0	80.38
272	H. A. H. 27	W.M.Z. (116)37	14 10 39	−27 16	72.4	5.99	1.1	8.0	9.0	80.35
273	β 116	L. 26177	14 13 3	−13 9	278.3	3.08	1.1	...		80.37
274	Σ 1833	L. 26267	14 16 18	− 7 13	167.3	5.50	1.1	6.0	6.5	80.45
275	O. S.	W. C. 5948	14 18 15	−27 35	275.6	0.82	2.½	8.0	9.2	80.38
276	β 225 B,C	χ Tur. Sol.	14 18 48	−19 26	101.0	1.36	2.2	8.0	9.2	80.38
277	Σ 1847	W xiv 379	14 22 14	− 9 40	256.9	23.24	1.1	...		80.37
278	H.V.E.	W xiv 388	14 22 58	−14 29	198.7	3.70	5.5	8.6	9.4	80.33
279	β 117	L. 26481	14 24 41	−15 5	92.0	2.41	1.1	7.5	8.5	80.38
280	h 2723	Anon.	14 25 24	−23 30	137.2	27.23	1.1	8.0	10.5	80.41
281	W. M. C. Z.	O. Arg. 13760	14 30 24	−29 10	111.3	20.12	2.2	8.0	8.8	80.35
282	β 226	L. 26665	14 32 5	−21 49	83.1	0.99	1.2	8.0	8.0	80.34
283	β 345	Lac. 6051	14 34 40	−29 11	299.4	0.90	1.1	7.8	8.5	80.42
284	Σ 1869	P. M. 1646	14 36 22	− 5 27	131.4	25.90	2.2	8.3	9.3	80.44
285	Sh 184	54 Hydræ	14 39 4	−24 56	129.4	8.90	2.2	5.0	7.0	80.42
286	Σ 1876	L. 26890	14 40 2	− 6 53	70.7	1.26	1.1	...		80.32
287	β 617 B,C	L. 26952	14 42 23	−23 45	337.2	2.14	2.2	8.8	11.5	80.38
288	β 118	O. Arg. 14034	14 47 1	−16 1	307.6	2.05	1.1	9.0	10.0	80.35
289	h 4716	Anon.	14 49 22	−24 10	357.8	2.92	1.1	9.0	10.0	80.44
290	Sh 190	Piazzi xiv 212	14 50 27	−20 52	289.5	15.25	1.1	8.0	9.5	80.35
291	β 239	59 Hydræ	14 51 33	−27 10	307.4	0.90	4.4	6.0	7.0	80.38
292	h 2757	L. 27229	14 51 47	−21 55	94.1	12.17	2.2	8.2	9.8	80.35
293	Σ 1899	L. 27342	14 55 21	− 2 41	66.6	28.84	2.2	6.5	10.0	79.30
294	Σ 3090	L. 27568	15 2 32	− 0 31	276.4	1.60	2.2	8.0	8.0	80.35
295	β 350	Lac. 6291	15 8 29	−27 9	157.5	1.23	1.1	7.0	8.0	80.44
296	β 352	O. Arg. 14427	15 10 43	−26 33	65.1	14.37	3.3	7.8	9.0	80.36
297	β 227	B. A. C. 5039	15 12 7	−23 50	180.2	1.90	1.1	7.0	9.5	80.42
298	h 4767	W.M.C.Z. (31)9	15 17 59	−26 30	142.2	32.62	2.2	8.0	9.8	80.39
299	H.V.E.	Anon.	15 18	−26 20	28.2	16.05	1.1	8.5	10.5	80.40
300	h 4769	L. 28062	15 18 24	−21 30	192.4	9.48	2.2	8.2	9.5	80.37

Number.	Double Star.	Name.	Mean R. A. 1880.	Mean Dec. 1880.	Position Angle.	Distance.	Weights.	Magnitudes.	Epoch 1800+
			h. m. s.	° ′	°	″			
301	h 4774	Lac. 6395	15 21 42	−28 27	6.5	9.17	1.2	6.8 10.0	80.39
301	Arg.S.54 A,B	O. Arg. 14768	15 34 30	−29 46	22.9	35.67	1.1	8.5 9.0	80.35
303	... A,C	...	...	...	328.0	60.	1.0	... 10.5	80.35
304	... A,D	...	...	...	320.1	89.10	1.1	... 9.5	80.35
305	h 4807	W. C. 6502	15 40 31	−20 52	1.9	10.35	1.1	8.0 11.0	80.44
306	β 36	2 Scorpii	15 46 24	−24 58	275.4	2.80	1.1	5.0 7.5	80.38
307	Sh 213	L. 29043	15 52 9	−19 35	319.0	17.83	4.4	8.0 8.6	80.38
308	h 4826	W.M.C.Z.(15)115	15 54 36	−29 22	247.9	5.02	2.2	9.0 9.8	80.42
309	β 38	L. 29136	15 55 39	−24 41	351.5	4.07	1.1	8.5 10.0	80.48
310	Σ 1998 A,B	ξ Scorpii	15 57 46	−11 2	188.8	1.11	2.2	...	80.36
311	... A,C	...	...	...	72.7	7.06	1.1	...	80.40
312	β 39	11 Scorpii	16 0 57	−12 25	256.9	3.20	1.1	6.0 9.0	80.48
313	h 4839	c^1 Scorpii	16 4 51	−28 6	77.2	4.36	2.2	6.0 8.2	80.42
314	β 120 A,B	ν Scorpii	16 5 1	−19 9	1.0	0.7	1.0	...	80.40
315	... C,D	...	...	...	43.2	2.07	1.1	...	80.40
316	Σ 2023	P. M. 1794	16 8 36	+ 5 50	230.8	1.6	1.0	...	80.32
317	β 624	O. Arg. 15565	16 15 42	−22 50	320.9	1.1	1.0	...	80.38
318	O. S.	O. Arg. 15637	16 19 49	−26 55	344.0	9.09	1.1	8.0 11.0	80.42
319	Σ 2046	P. M. 1820	16 19 51	+64 39	224.3	8.21	1.1	9.0 10.0	79.31
320	Σ 3105	L. 30053	16 25 21	− 6 46	42.7	0.72	2.½	8.0 8.2	80.38
321	Σ 3106	W xvi 912	16 49 17	− 4 58	66.2	2.28	2.1	...	80.44
322	Sh 240	Piazzi xvi 236	16 50 0	−19 21	230.8	4.84	2.2	6.5 7.8	80.47
323	h 4902	L. 30779	16 50 26	−27 35	30.0	11.11	2.1	8.0 9.0	80.44
324	h 589	L. 31181	17 3 29	−24 47	300.7	9.78	1.1	8.5 9.5	80.46
325	Σ 2132	L. 31290	17 6 26	− 3 54	109.9	1.6	2.0	8.0 9.0	80.44
326	Sh 243	36 Ophiuchi	17 7 59	−26 25	21.8	4.22	1.1	....	80.60
327	β 282 A,C	Lamont XII 2082	17 8 30	−14 27	153.1	4.25	1.1	6.0 10.5	80.44
328	h 4932	O. Arg. 16530	17 8 43	−18 3	226.2	10.00	1.1	8.5 10.5	80.46
329	O. S.	Anon.	17 11	−16 55	288.7	16.87	2.2	8.0 8.5	80.46
330	O. S.	O. Arg. 16653	17 14 13	−17 55	44.3	0.82	2.½	8.5 9.5	80.40

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			h. m. s.	° ′	°	″			
331	h 4953	O. Arg. 16774	17 19 19	−19 25	174.2	18.14	2.2	8.5 9.5	80.40
332	Arg. S. 66	L. 31784	17 22 42	−17 43	194.9	8.46	1.1	...	80.38
333	Σ 2173	B. A. C. 5910	17 24 14	− 0 58	...	0.52	0.½	6.0 6.5	80.55
334	Σ 2183 rej A,C	L. 32017	17 29 5	− 5 51	13.4	28.30	1.1	7.0 9.0	80.40
335	Σ 2191	L. 32179	17 33 25	− 4 54	266.6	26.68	2.2	7.5 8.2	79.96
336	Arg. S. 67	O. Arg. 17099	17 35 30	−29 53	290.3	36.81	1.1	8.0 8.5	80.38
337	H. A. H.	W.M.Z.(27)48	17 44 38	−28 27	8.7	6.54	2.2	8.5 9.8	80.44
338	W. M. C. Z.	O. Arg. 17320	17 46 12	−28 40	2.2	2.01	1.1	10.0 11.0	80.52
339	Σ 2244	Tauri Pon. 9	17 50 55	+ 0 5	276.9	1.34	1.2	7.0 7.6	80.56
340	Σ 2262	τ Ophiuchi	17 56 33	− 8 11	249.7	1.78	3.3	5.5 6.5	80.07
341	h 5009	W. C. 7599	17 56 54	−24 15	19.9	3.86	1.1	9.0 9.5	80.58
342	H. V. E.	Anon.	17 57	−25 28	15.9	4.46	1.1	9.0 9.2	80.58
343	h 5010	O. Arg. 17564	17 57 15	−24 20	348.4	3.57	1.1	9.0 9.5	79.59
344	Σ 2272	70 p Ophiuchi	17 59 23	+ 2 32	67.9	2.94	5.5	...	79.64
345	O. S. 88	Anon.	18 0	−19 0	276.9	19.81	1.1	9.0 9.5	80.57
346	β 244	L. 33188	18 1 1	−27 53	257.3	2.01	1.1	...	80.58
347	β 132	B. A. C. 6158	18 4 7	−19 52	59.2	1.03	3.2	7.5 7.6	80.14
348	h 5035	μ Sagittarii	18 6 35	−21 5	259.3	17.12	1.1	5.0 9.0	80.53
349	β 131	L. 33443	18 6 42	−15 38	279.6	2.71	1.1	...	80.58
350	h 2823	Anon.	18 7 55	−19 59	332.3	20.34	2.2	8.8 9.2	80.51
351	β 285	O. Arg. 17953	18 9 26	−25 3	324.2	1.2	1.0	8.0 10.0	80.60
352	h 2827	Anon.	18 9 59	−19 55	251.5	20.16	1.1	9.0 9.5	80.58
353	Sh 264	L. 33642	18 11 40	−18 40	51.4	17.40	1.1	6.0 8.0	79.27
354	β 48	L. 33729	18 13 54	−19 43	0.6	2.36	1.1	9.0 9.5	80.58
355	O. S.	Anon.	18 16	−18 55	84.6	6.72	1.1	8.5 9.0	79.30
356	β 49	O. Arg. 18155	18 17 3	−19 37	44.8	7.9	2.0	...	80.52
357	Jacob 201	21 Sagittarii	18 18 12	−20 36	295.4	2.15	1.2	5.0 8.0	80.56
358	β 247	L. 34253	18 25 37	− 9 27	169.0	7.42	1.1	7.0 10.0	80.59
359	Σ 2434 B,C	L. 35545	18 56 34	− 0 53	64.2	1.81	1.1	8.0 10.5	79.68
360	S 711	O. Arg. 19092	19 0 41	−27 1	123.4	45.87	1.1	7.5 8.5	80.38

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			h. m. s.	° ′	°	″			
361	h 1373	Anon.	19 6	−18 20	242.1	9.04	1.1	9.5 10.0	80.44
362	β 138	L. 36013	19 6 37	−14 39	281.7	1.09	1.1	8.0 10.0	80.59
363	H. A. H. 95	L. 36414	19 14 38	+ 2 43	149.4	0.42	1.½	6.0 6.5	79.69
364	H. A. H.	O. Arg. 19458	19 15 56	−18 13	81.8	2.56	2.2	9.0 9.3	80.51
365	h 2866 A,B	O. Arg. 19469	19 16 29	−18 13	53.0	23.38	2.2	8.0 8.3	80.58
366	... A,C	...	...	...	137.1	23.91	1.1	...	80.58
367	... B,C	...	...	...	276.0	34.87	1.1	... 8.5	80.57
368	O. S.	Anon.	19 20	−16 11	195.4	4.84	2.2	6.8 7.3	80.62
369	β 423	O. Arg. 19560	19 20 18	−29 44	119.6	1.19	1.1	7.0 8.0	79.69
370	Σ 2541	L. 37113	19 30 12	−10 42	332.4	3.72	1.1	8.0 10.0	80.60
371	Σ 2545	L. 37207	19 32 8	−10 26	320.9	3.68	2.2	7.0 8.5	80.56
372	h 5144	Anon.	19 38 27	−25 49	9.4	10.32	2.2	7.5 8.8	80.10
373	A. C. 12	L. 38059	19 52 8	− 2 33	324.7	1.13	2.2	...	80.56
374	h 5164	O. Arg. 20141	19 53 31	−27 31	122.2	9.30	2.2	8.0 9.0	79.69
375	h 2918	L. 38161	19 54 58	−17 53	134.2	16.55	1.1	...	80.44
376	Σ 2646	Aquilæ 241	20 8 1	− 6 25	48.1	23.17	1.1	7.5 9.0	80.56
377	Arg. S. 84	O. Arg. 20438	20 15 24	−20 36	267.4	17.93	1.1	...	79.71
378	H. A. H.	Anon.	20 20	−27 10	55.0	2.77	1.1	8.5 9.0	79.79
379	II ii 51	ρ Capricorni	20 22 1	−18 13	172.1	3.14	1.1	5.0 7.0	79.71
380	H iv 71	o Capricorni	20 23 1	−18 59	239.0	22.22	1.1	6.0 6.5	80.56
381	O. S.	Anon.	20 31	−26 55	245.3	1.42	2.1	8.2 8.5	79.78
382	h 921	Lamont IX 3926	20 35 21	− 4 56	37.3	9.36	1.1	...	80.56
383	β 267	Anon.	20 35 25	− 4 50	240.5	2.04	1.1	10.0 10.0	79.59
384	β 674	W. C. 9020	20 37 53	−21 19	103.4	1.35	2.1	8.0 10.8	79.78
385	h 5220	Lac. 8555	20 39 16	−27 18	354.8	17.99	1.1	8.0 9.0	80.52
386	β 154	L. 40292	20 46 6	−16 37	59.8	2.88	2.2	8.0 9.2	79.69
387	Σ 2745	12 Aquarii	20 57 44	− 6 18	190.8	2.91	2.2	5.8 7.8	80.58
388	h 5252	O. Arg. 21208	21 5 43	−15 29	320.3	3.10	1.1	...	80.56
389	H. V. E.	Anon.	21 8	− 1 20	59.9	99.40	1.1	9.0 9.5	79.66
390	Σ 2781	L. 41284	21 10 20	− 8 9	169.2	3.06	1.1	8.0 8.2	80.56

Number.	Double Star.	Name.	Mean R. A.	Mean Dec. 1880.	Position Angle.	Distance.	Weights.	Magnitudes.	Epoch 1800+
			h. m. s.	° ′	°	″			
391	β 271	Lac. 8777	21 12 50	−26 51	231.8	2.30	2.2	6.5 9.0	79.69
392	Σ 2787	Schj. 8640	21 15 42	+ 1 31	19.4	22.62	1.1	...	79.78
393	β 272	L. 41564	21 17 50	−13 19	255.7	4.31	1.1	8.0 12.0	79.79
394	H. A. II.	O. Arg. 21368	21 18 33	−20 54	142.9	8.22	1.1	8.0 10.0	79.54
395	β 683	L. 41683	21 20 43	−20 44	197.3	2.5	1.0	8.5 12.0	79.79
396	β 165	L. 41954	21 27 55	− 3 59	178.4	4.74	1.1	8.0 10.5	79.79
397	Σ 2809	B. A. C. 7515	21 31 24	− 0 56	162.4	30.95	1.1	...	79.69
398	H.A.H. A,B	W xxi 950	21 40 57	−13 42	105.5	0.82	1.½	8.0 10.0	79.77
399	Σ 2826 A,C	...	...	...	79.4	3.93	1.1	8.0 9.0	79.54
400	O. S. 110	O. Arg. 21650	21 41 25	−27 42	175.9	2.82	1.1	8.0 9.5	79.75
401	h 3059	Lac. 8937	21 43 50	−28 30	253.7	24.91	1.1	7.0 11.0	79.75
402	h 615	L. 42645	21 47 7	−17 19	67.1	12.30	2.2	7.5 9.0	79.75
403	Σ 2838	Aquarii 100	21 48 21	− 3 52	185.0	19.79	1.1	...	80.56
404	Σ 2839 rej.	L. 42692	21 48 34	−12 32	274.2	30.90	1.1	7.5 9.5	79.77
405	h 3068	W.T. Z. (81)25	21 50 49	−28 21	287.4	10.45	2.1	8.2 11.0	79.76
406	Σ 2847	L. 42810	21 51 53	− 4 4	122.4	1.06	2.2	7.0 8.0	79.69
407	Σ 2848	L. 42827	21 52 1	+ 5 12	55.5	9.79	1.1	7.0 8.0	79.74
408	O. S. 111	11 Piscis Aus.	21 52 42	−28 12	35.6	11.75	5.4	7.0 10.0	79.76
409	β 256	η Piscis Aus.	21 53 56	−29 2	113.7	1.73	1.1	5.5 7.0	80.56
410	S 802	29 Aquarii	21 55 53	−17 33	243.4	3.68	1.1	...	80.56
411	β 475	L. 43305	22 6 16	− 8 36	230.6	1.	1.0	7.0 11.0	79.75
412	H n 56	41 Aquarii	22 7 40	−21 40	115.0	4.82	2.2	6.8 8.2	79.76
413	β 171	L. 43350	22 7 51	−21 38	257.9	11.4	1.0	8.5 12.0	79.75
414	O. S.	Anon.	22 8	−20 40	95.7	9.41	1.1	8.0 12.0	79.75
415	H n 102	Anon.	22 9 49	− 3 30	294.6	12.89	1.1	9.5 9.5	79.74
416	Σ 2885 rej.	P. M. 2689	22 9 56	− 8 17	98.8	21.96	1.1	8.0 12.0	79.75
417	Σ2892 rej. A,B	P. M. 2697	22 12 55	−11 23	58.1	9.	1.0	... 12.0	79.75
418	... A,C	...	...	...	263.7	36.29	1.1	8.0 9.0	79.75
419	h 962 A,B	30 Pegasi	22 14 25	+ 5 11	17.3	5.97	2.1	... 11.0	79.74
420	... A,C	...	...	...	223.0	9.79	1.1	5.5 10.5	79.75

Number.	Double Star.	Name.	Mean R. A. 1880.	Mean Dec. 1880.	Position Angle.	Distance.	Weights.	Magnitudes.	Epoch 1800+
			h. m. s.	° ′	°	″			
421	Σ 2901	L. 43731	22 18 23	+ 3 13	144.6	3.00	1.1	9.0 9.5	79.76
422	Sh 345	53 Aquarii	22 20 3	—17 21	305.6	7.65	2.2	7.0 7.0	80.56
423	Σ 2909	ζ Aquarii	22 22 39	— 0 38	331.8	3.28	6.6	4.5 4.5	79.88
424	Σ 2913	L. 43936	22 24 14	— 8 44	330.0	7.73	1.1	8.0 9.0	79.75
425	Σ 2928	L. 44276	22 33 10	—13 14	135.8	4.27	10.10	8.5 8.7	79.83
426	Σ 2940	P. M. 2750	22 38 2	+72 6	138.8	2.78	1.1	9.0 10.0	79.75
427	h 1811	Lamont XI 3203	22 42 56	+12 29	153.7	5.61	1.1	8.5 9.0	79.74
428	Σ 2948	P. M. 2758	22 45 20	+65 55	3.0	2.70	2.2	7.0 9.0	79.75
429	Σ 2953	P. M. 2763	22 48 2	+60 17	136.2	8.53	1.1	8.0 11.0	79.75
430	O. S.	Anon.	22 52	— 9 7	132.5	2.46	2.1	7.0 8.0	80.56
431	h 1838	O. Arg. 24973	22 53 56	+66 26	265.9	2.10	2.2	10.0 11.0	79.75
432	Σ 2971	P. M. 2779	22 54 12	+77 51	2.9	5.34	2.2	8.0 9.0	79.62
433	Σ 2970	P. M. 2780	22 56 6	—11 57	36.7	8.02	1.1	8.5 9.5	79.74
434	h 3174	W xxiii 22	23 3 53	— 8 43	17.4	5.47	1.1	8.5 9.0	79.74
435	β 714	L. 45468	23 7 57	— 3 17	156.6	0.6	1.0	7.0 11.0	79.76
436	h 981	Lamont V 9129	23 8 2	+ 2 13	280.7	17.97	1.1	8.5 12.0	79.74
437	β 715	Aquarii 290	23 8 25	—11 21	257.2	3.08	1.1	6.0 11.5	79.77
438	Σ 2996	P. M. 2805	23 8 39	+81 10	105.3	5.14	1.1	8.5 9.0	79.75
439	h 5393	L. 45605	23 12 0	—25 37	304.6	18.92	1.1	8.0 10.0	79.77
440	h 5394	96 Aquarii	23 13 10	— 5 47	21.0	10.61	3.3	5.5 10.5	79.78
441	Σ 3003	P. M. 2813	23 13 22	+82 48	266.3	23.57	1.1	...	79.75
442	h 3189	L. 45801	23 17 23	— 0 22	133.2	41.67	1.1	...	79.74
443	Σ 3008	Piazzi xxiii 69	23 17 32	— 9 7	253.7	4.77	3.3	6.8 7.8	79.98
444	Σ 3011	P. M. 2820	23 19 36	+76 25	330.8	7.06	1.1	...	79.75
445	H.V. E.	Anon.	23 20	—22 3	51.7	7.	1.0	...	79.90
446	Σ 3014	P. M. 2822	23 21 52	+10 29	277.7	7.75	1.1	7.5 9.5	79.74
447	h 3196	O. Arg. 22868	23 23 37	—21 14	18.8	20.14	2.1	9.0 10.0	80.70
448	h 3197	Anon.	23 23 51	—17 57	307.8	8.33	2.2	8.5 9.5	79.79
449	β 726	Anon.	23 40	—13 25	326.6	0.77	2.1	8.0 10.2	79.77
450	H.V. E. 124	Anon.	23 41	+16 27	86.1	1.38	1.1	8.5 9.0	79.74

Number.	Double Star.	Name.	Mean R. A. 1880.	Mean Dec. 1880.	Position Angle.	Distance.	Weights.	Magnitudes.	Epoch 1800+
			h. m. s.	° ′	°	″			
451	Σ 3040	P. M. 2852	23 42 0	+ 9 29	216.0	4.20	1.1	8.5 8.5	79.74
452	Σ 3045	P. M. 2856	23 48 17	+ 1 48	257.1	1.79	1.1	8.0 9.0	79.74
453	Σ 3046	L. 46916	23 50 14	—10 10	244.5	3.18	1.1	...	79.75
454	Weisse	W xxiii 1071	23 53 42	+ 1 12	88.4	1.85	2.2	8.5 9.0	79.74
455	Σ 3052	P. M. 2864	23 56 46	+70 41	6.8	33.95	1.1	...	79.75

University of Cincinnati.

PUBLICATIONS

OF THE

Cincinnati Observatory.

—7—

OBSERVATIONS OF COMETS.

1880-82.

PUBLICATIONS OF THE CINCINNATI OBSERVATORY.

—7—

OBSERVATIONS OF THE COMETS

OF 1880, 1881 AND 1882,

MADE UNDER THE DIRECTION OF

ORMOND STONE, A. M., ASTRONOMER,

AND

HERBERT C. WILSON, A. M., ASTRONOMER, *pro tem.*,

Prepared for publication by the latter.

CINCINNATI:
PUBLISHED BY AUTHORITY OF THE BOARD OF DIRECTORS OF THE UNIVERSITY.
1883.

CONTENTS.

INTRODUCTION.

IN June, 1882, Professor Ormond Stone resigned his position as Astronomer of the Cincinnati Observatory, to accept a position as Director of the Leander McCormick Observatory and Professor of Practical Astronomy in the University of Virginia. Since then I have been in charge of the Observatory as Astronomer *pro tem.*

Upon the advice of Professor Stone I have devoted my time during the day principally to the reduction and preparation for publication of the miscellaneous observations which remain unpublished. The present number of the Publications of this Observatory contains the observations of comets made under Professor Stone's direction, and those made by myself during the latter half of 1882. Previous to 1880 no attention was paid to comets, the equatorial being occupied almost entirely with double-star observations. In the fall of 1880, the driving apparatus of the equatorial having been sent to Messrs. Fauth & Co., of Washington, for repairs and new attachments, a few observations of the comets *d* and *f*, 1880, were made. In June, 1881, the great comet *b*, which so suddenly appeared above our horizon, followed in July by another (*c*) of considerable dimensions, drew attention more especially to the field of cometary astronomy, and since that time comets have been observed whenever opportunity offered.

The observers have been: Professor Ormond Stone and Messrs. H. V. Egbert, F. P. Leavenworth, John Jones and H. C. Wilson. These names are designated in the column marked observer by the initial letters S, E, L, J and W.

The instruments used were the equatorial, chronograph, sidereal clock and sidereal chronometer. It will not be necessary to give here a detailed description of these instruments. A few points will be needed, however, to explain the observations.

The Equatorial.—The object-glass is by Merz & Mahler, of Munich; refigured by Alvan Clark & Sons, in 1876. Its aperture is 11¼ inches.

The filar micrometer has three wires of spider web; two parallel and separately movable by screws; the other fixed at right angles to these. The screw which moves one of the parallel wires has a graduated head. The value of one revolution of this screw is 13″.651. The wires are illuminated by lamp-light admitted through the side of the tube close to the micrometer. The position circle is graduated to 15′, and reads by verniers to 1′. The readings increase from right over to left or from north toward east.

The ring-micrometer has two rings, of which the diameters, as derived from five transits of the stars 17, 23, η and 27 Tauri, on October 14, 1881, are as follows:

	Outer diameter.	Inner diameter.
Large ring,	510″.3	464″.5
Small ring,	264.4	224.3

The eye-pieces used with the filar micrometer have the following magnifying powers:

I	magnifies	95	times.
II	"	150	"
III	"	230	"
A	"	450	"

In the observations of position of the comets eye-piece *I* was always employed, unless otherwise stated in the notes.

The finder has an object-glass of 2½ inches aperture, and an eye-piece magnifying 30 times.

The Chronograph is by Wm. Bond & Son, of Boston. The barrel of the Chronograph is 6 inches in diameter, 13½ inches in length, and revolves once in a minute. The motive power is electricity. The beats of the clock and observer's signals are registered by a single Mackinnon stylographic pen.

The Sidereal Clock is by Robert Molyneux, of London. It has a mercurial pendulum and a make-circuit connection with the chronograph. The point of the pendulum, at the middle of each oscillation, dips into a globule of mercury, thus completing the circuit through the chronograph. The clock is placed on a solid stone pier in the transit room, free from the vibrations of the building. In October, 1880, a large case, 3⅔ feet square on the outside, was built around the clock to prevent sudden changes of temperature. This case is double and nearly air-tight. A window of three thicknesses of ⅜-inch plate glass with air-spaces between, enables the observer to see the face of the clock and a thermometer hung within, without opening the case. The case is opened once a week when the clock is wound. The effect of this case is to reduce the changes of temperature within it, so that there is hardly ever a variation of more than 2° in one day. The errors of the clock have been determined once or twice a week by transits of stars taken with a 3-inch Buff & Berger transit. Its rate has generally been very satisfactory.

The Sidereal Chronometer.—This is a break-circuit chronometer by Wm. Bond & Son. It was seldom used with the chronograph. Its error was determined each day by comparison with the Molyneux clock.

OBSERVATIONS OF POSITION.

The observations for the position of the comets were made with the equatorial, and, with the exception of two dates, the filar micrometer. On September 24 and October 14, 1881, the ring-micrometer was used. The times of the observations were generally recorded on the chronograph with the Molyneux clock. On

a few dates the chronometer was connected with the chronograph, and on a few dates the times were noted by the eye and ear method on the chronometer.

Method of Observation.—The movable wires were first placed parallel to the equator by turning the micrometer until a star, passing through the field of view by the rotation of the earth, was bisected by one of the wires during the whole of its passage. With the micrometer clamped in this position, two or more measures of the difference in declination between the comet and comparison star were made, the times being noted for each bisection of the comet. Then the micrometer was rotated 90° on the position circle, the wires placed at a convenient distance apart, and the times of transit of star and comet over both wires noted. Several transits were thus taken, then the micrometer was turned back to its original position, or 180° from the latter, and the difference in declination again measured, the number of measures being equal, if possible, to those first taken. Sometimes the parallel was again determined, but this was not generally done. When possible, without having too great a difference in right ascension, the comparison star was selected so that both comet and star should pass near the center of the field of view.

The Printed Columns.—The first column contains the reference number, the second the date, the third the Mt. Lookout mean solar times of the observations. The latter were obtained by taking the mean of the times for the bisection of the comet in the measures of declination and the mean of the times of transit of the comet for the differences in right ascension. The observed times being sidereal, they were reduced to mean solar time.

The fourth column contains the means of the differences in the times of transit of the comet and comparison star. The sixth contains the means of the measures of difference in declination.

The fifth and seventh give the corrections to be applied to $\Delta\alpha$ and $\Delta\delta$ for refraction.

Column eight gives the number of comparisons included in the means given in the third, fourth and sixth columns.

The tenth and twelfth columns give the apparent right ascension and declination of the comet, obtained by adding the observed differences $\Delta\alpha$ and $\Delta\delta$, and the corrections for refraction, to the assumed apparent position of the comparison star.

The eleventh and thirteenth columns give the corrections for parallax. The constant of solar parallax was assumed 8″.848.

The fourteenth column gives the initial of the observer's name, the fifteenth the reference number of the comparison star. The last gives such notes as refer to the observation of position.

Assumed Places of Comparison Stars.—The places of the comparison stars were taken from the following catalogues:

	Epoch.
Fedorenko.—*Etoiles circumpolaires.*	1790.0
Lalande.—*Baily's.*	1800.0
Weisse.—*Positiones mediæ stellarum fixarum.*	1825.0
Rümker.—*Catalogue of* 12,000 *stars.*	1836.0

	Epoch.
O. Arg. N.—*Oeltzen's "Argelander's Zonen-Beobachtungen."*	1842.0
O. Arg. S.— " " " "	1850.0
Radcliffe.—*Catalogue of* 6317 *stars.*	1845.0
Lamont.—*Verzeichniss von telescopischen Sternen.*	1850.0
Washington.—*Mural Circle Zones.*	1850.0
Carrington.—*Catalogue of* 3735 *circumpolar stars.*	1855.0
DM.—*Argelander's astronomische Beobachtungen zu Bonn.* Band III, IV, V.	1855.0
Bonn.— " " " " " Band VI.	1855.0
Gr. Nine Yr. Catalogue.—*Greenwich Nine Year Catalogue of* 2263 *stars.*	1872.0
539 Sterne.—*Catalogue of the "Astronomische Gesellschaft."*	1880, 1881, 1882.

A few star places were also obtained from the *Astronomische Nachrichten*, and a number were not found in any catalogue.

The star places were reduced to the beginning of the year of observation by Table XX of the *Star Tables of the American Ephemeris.* The reductions to the apparent places at the times of observation were computed by the formulæ

$$da = f + g \sin (G + \alpha) \operatorname{tg} \delta + h \sin (H + \alpha) \sec \delta$$
$$d\delta = i \cos \delta + g \cos (G + \alpha) + h \cos (H + \alpha) \sin \delta.$$

The quantities f, g, h, i, G and H were taken from the *Berliner astronomische Jahrbuch.*

The first column gives the reference number of the star, the second the mean right ascension and the fourth the mean declination of the star at the beginning of the year. The third and fifth columns give the reductions to the apparent place for the date of observation. The sixth column gives the catalogue from which the place of the star was obtained. Those stars not found in any catalogue are marked anonymous.

PHYSICAL OBSERVATIONS.

These consisted of sketches, measures, and notes in regard to the appearance of the comets. They were generally made just before or just after the position observations.

The sketches of the tail of Comet *b*, 1881, and of Comet *c*, 1882, were made either in the dome or at an open window of the library. An opera-glass, magnifying 2½ diameters, was sometimes used. Upon the pencil sketches all the stars visible in the vicinity of the comet were plotted as accurately as possible with the eye. The stars were afterward identified in *Heis's Atlas Cœlestis* and plotted to a scale three times that of the engravings. The position of the nucleus was then plotted and the tail drawn in the same proportion, relative to the stars, as on the original sketch.

The sketches of the head were made with the 11-inch equatorial. Unless otherwise stated eye-piece *I* was used.

The drawings from which the Plates *II, III, IV, V, VII, VIII* were reduced were compiled by myself from the original sketches. The scales were chosen so as to enlarge most of the sketches about three times, then in the pro-

cess of photo-engraving they were reduced to one-third, so that the engravings are of very nearly the same size as the original sketches. On the plates the drawings are arranged symmetrically with reference to the direction of the sun. A line from the sun through the nucleus is parallel to the side of the plate. The deviation of any part of the comet from the direction toward or opposite the sun is thus shown at a glance. On Plates *II* and *VII* the direction of the sun is toward the bottom, while on Plates *III*, *IV*, *V* and *VIII* it is toward the top of the page. The arrows denote the direction of apparent diurnal motion, or position angle 270°.

Plate *I* gives a map of that portion of the sky through which Comet *b*, 1881, moved, the apparent course of the nucleus and the outlines of the tail on the several dates of observation. Plate *VI* gives a similar map for Comet *c*, 1882. The stars were plotted from *Heis's Atlas*, their positions being corrected for precession from 1855 to 1881 and 1882. All the stars down to the six and a half magnitude were included.

Reductions.—In the reduction and discussion of the tail-observations, I have followed the method of Professor Bredichin, the Director of the Observatory of Moscou. His theory and methods of investigation are fully explained in the *Annals of the Moscou Observatory* (*Vol. V, livr. 2 and VII, livr. 2*) and in *Copernicus* (*Vol. I, page* 99–115).

The theory is briefly this: The tail of a comet consists of particles of matter emitted from the nucleus and repelled by a force $(1-\mu)$ the reverse of gravitation. The effective force which acts upon the particle is μ, which, combined with the tangential velocity of the nucleus, causes the particle to describe a hyperbolic orbit. This orbit will be convex or concave to the sun, according as the repulsive force $(1-\mu)$ is greater or less than unity. When $1-\mu=1$, *i. e.*, when the effective force of the sun is *o*, the particle moves in a straight line in the direction of the tangent, and with a constant velocity equal to that of the nucleus at the moment of emission. The path of the particle will also be modified by the initial velocity (g) and direction (G) of its emission from the nucleus. As the discharge of matter from the nucleus usually takes place from the side toward the sun, the repelled particles are driven outward past the nucleus on all sides, forming a hollow conoid, whose axis lies in the plane of the orbit of the nucleus.

Professor Bredichin has investigated the observations of a large number of bright comets, and concludes that they may be referred to three general types, for which the theoretical values of $1-\mu$ are 12 (type *I*), 1 (type *II*) and 0.3 (type *III*), expressed in units of the Newtonian force. The value of $1-\mu$ for the second type varies between 2.6 and 0.8. In some of the great comets there have been several conoids belonging to the same type, diverging slightly so as to broaden the extremity of the tail. The tail of type *I* is usually long, narrow and nearly straight. Type *II* is much shorter, broader and more curved. Type *III* is very short and faint, and deviates widely from the direction opposite the sun. The initial velocities derived for the three types are 0.15 (*I*), 0.03 (*II*) and 0.01 (*III*), for which the unit of time is 58.13244 days ($=\frac{1}{k}$, k being the constant of solar attraction), and the unit of distance is the mean radius of the earth's orbit.

As to the constitution of comets' tails, Professor Bredichin offers the hypothesis, that the different conoids consist of particles whose atomic weights are inversely proportional to the repulsive forces $1-\mu$. Thus type *I* contains hydrogen, type *II* carbon or compounds of carbon and hydrogen, and type *III* metallic vapors, such as iron, sodium, etc. (*Annales de l'Observatoire de Moscou, Vol. V, livr. 2, VI livr. 1, VII, livr. 2.*)

I have computed the position angle and distance of the observed points from the nucleus and reduced them to the plane of the orbit by Bessel's formulæ (*Astronomische Nachrichten*, No. 300 and 1172). The angles (ϕ) of the observed points from the prolongation of the radius vector, were reduced to the same epoch by Bredichin's formulæ (*Annales de l' Observatoire de Moscou, VIII*, 1). For the comparison of the observations with theory, I have computed, for the chosen epochs, the positions of particles emitted from the nucleus at various times and repelled by different forces ($1-\mu$), corresponding to the general types *I*, *II* and *III*. These positions are represented on Plates *IX* and *X*, together with the observed points. The curved lines drawn through them represent the axes of the various conoids.

In the reduction of the head-observations the position angles were compared with the direction toward instead of opposite the sun.

Below is a collection of the formulæ used in the reduction and discussion of the tail-observations, with explanation of the notation used:

For the position angle p and distance s of the observed point in the tail, and the position angle p_0 of the radius vector prolonged

$$\operatorname{tg}\phi=\operatorname{cotg}\delta'\cos(\alpha'-\alpha) \qquad \operatorname{tg}\phi=\operatorname{cotg}\delta\cos(\alpha-\alpha)$$
$$\operatorname{cotg}p=\cos(\delta+\phi)\operatorname{cotg}(\alpha'-\alpha)\operatorname{cosec}\phi \qquad \operatorname{cotg}p_0=\cos(\delta+\phi)\operatorname{cotg}(\alpha-\alpha)\operatorname{cosec}\phi$$
$$\cos s=\sin(\delta+\phi)\sin\delta'\sec\phi$$

α and δ = right ascension and declination of the nucleus.
α' and δ' = " " " " " observed point.
α and δ = " " " " " sun.

For the reduction to the plane of the orbit (*Astronomische Nachrichten*, No. 300 and 1172):

$$A=\Omega'-90^\circ \qquad D=90^\circ-i'$$
$$\cos S=-\sin\delta\sin D-\cos\delta\cos D\cos(A-\alpha)$$
$$\sin S\cos P=\cos\delta\sin D-\sin\delta\cos D\cos(A-\alpha)$$
$$\sin S\sin P=\cos D\sin(A-\alpha)$$
$$\sin S\cos P'=-\sin\delta\cos D+\cos\delta\sin D\cos(A-\alpha)$$
$$\sin S\sin P'=-\cos\delta\sin(A-\alpha)$$

$$\operatorname{tg}G=\operatorname{cotg}D\cos(A-\alpha) \qquad \operatorname{tg}G'=\operatorname{cotg}\delta\cos(A-\alpha)$$
$$\operatorname{tg}P=\sin G\operatorname{tg}(A-\alpha)\sec(G+\delta) \qquad \operatorname{tg}P'=\sin G'\operatorname{tg}(A-\alpha)\sec(G'+D)$$
$$\operatorname{cotg}S=-\operatorname{tg}(G+\delta)\cos P=\operatorname{tg}(G'+D)\cos P'$$

$$n\sin(u-P')=-\sin(p-P) \qquad m\sin(u_0-P')=-\sin(p_0-P)$$
$$n\cos(u-P')=-\cos(p-P)\sec S \qquad m\cos(u_0-P')=-\cos(p_0-P)\sec S$$
$$\operatorname{tg}(u-P')=\operatorname{tg}(p-P)\cos S \qquad \operatorname{tg}(u_0-P')=\operatorname{tg}(p_0-P)\cos S$$

$$\phi=u_0-u$$
$$\cos T=\sin S\cos(u-P')$$
$$\Delta=\rho\sin s\operatorname{cosec}(T+s).$$

A and D = right ascension and declination of north pole of comet's orbit.
Ω' and i' = ascending node and inclination of comet's orbit referred to the plane of the equator.

P = position angle of the north pole of the comet's orbit at the geocentric place of the comet.
P' = position angle of the cometocentric place of the earth at the pole of the comet's orbit.
S = cometocentric distance of the earth from the pole of the comet's orbit.
T = cometocentric angle between the earth and the observed point in the tail.
u = position angle of the observed point referred to the pole of the comet's orbit.
u_0 = position angle of the radius vector referred to the pole of the comet's orbit.
ϕ = angle at the nucleus between the observed point and the radius vector prolonged.
ρ = distance of the nucleus from the earth.
Δ = distance of the observed point from the nucleus.

For the reduction of the angles ϕ to the same epoch (*Annales de l' Observatoire de Moscou, VIII*, 1):

$$d\phi = -\cos^2\phi \cdot \text{F.}\ 1\sqrt{\xi}\sin\tfrac{1}{2}(v_0+v)\sin\tfrac{1}{2}(v_0-v) \div \sin 1'$$

$$F = \tfrac{4}{3}\frac{1}{\sqrt{q}\sqrt{1-\mu}} \qquad \xi = \Delta\cos\phi$$

v_0 = true anomaly of the nucleus at the given epoch.
v = " " " " " time of observation.
q = perihelion distance of comet.

For the theoretical representation of the observations (*Annales de l' Observatoire de Moscou, VII*, 2, and "*Copernicus*," *Vol. I, page* 107–108):

$$H^2 = \frac{2}{r_1} \qquad \beta = 90^\circ - \frac{v_1}{2} \qquad m = \frac{H^2 r_1}{\mu}$$

Orbit convex to the sun $(1-\mu > 1)$

$E^2 = m\sin^2\beta\,(m+2)+1$ $\qquad \cos V_1 = (m\sin^2\beta+1)\cos\psi$

$\cos\psi = \frac{1}{E}$ $\qquad P = 2r_1 E\sin\tfrac{1}{2}(\psi+V_1)\sin\tfrac{1}{2}(\psi-V_1)$

$b = P\operatorname{cotg}^2\psi$ $\qquad N = \frac{\lambda K t}{b^{\frac{3}{2}}} = \lambda E\operatorname{tg}F + \log\operatorname{tg}(45^\circ+\tfrac{1}{2}F)$

$\operatorname{tg}\tfrac{1}{2}V = \operatorname{tg}\tfrac{1}{2}F\operatorname{tg}\tfrac{1}{2}\psi$ $\qquad R = \frac{P}{2E\sin\tfrac{1}{2}(\psi+V)\sin\tfrac{1}{2}(\psi-V)}$

Orbit concave to the sun $(1-\mu < 1)$

$E^2 = m\sin^2\beta\,(m-2)+1$ $\qquad \cos V_1 = (m\sin^2\beta - 1)\cos\psi$

$\cos\psi = \frac{1}{E}$ $\qquad P = 2r_1 E\cos\tfrac{1}{2}(\psi+V_1)\cos\tfrac{1}{2}(\psi-V_1)$

$b = P\operatorname{cotg}^2\psi$ $\qquad N = \frac{\lambda K t}{b^{\frac{3}{2}}} = \lambda E\operatorname{tg}F - \log\operatorname{tg}(45^\circ+\tfrac{1}{2}F)$

$\operatorname{tg}\tfrac{1}{2}V = \operatorname{tg}\tfrac{1}{2}F\operatorname{cotg}\tfrac{1}{2}\psi$ $\qquad R = \frac{P}{2E\cos\tfrac{1}{2}(V+\psi)\cos\tfrac{1}{2}(V-\psi)}$

$$\log k = 8.2355814 - 10;\ \log \lambda = 9.6377843 - 10$$

$$\omega = v_1 - V_1 + V \qquad \Delta^2 = r^2 + R^2 - 2\,r\,R\cos(v-\omega)$$

$$\eta = R\sin(v-\omega) \qquad \frac{\eta}{\Delta} = \sin\phi \qquad \xi = \Delta\cos\phi$$

Orbit straight $(1-\mu=1)$

$$\tau = (M - M_1)\,k \qquad R^2 = s^2 + r_1^2 + 2\,s\,r_1\cos\beta$$

$$s^2 = \frac{2\,\tau^2}{r_1} \qquad \sin a = \frac{s\sin\beta}{R} \qquad \omega = v_1 + a$$

If the initial velocity g and the angle G be taken into consideration, H_1 and β_1 must be substituted for H and β.

$$H_1^2 = H^2 + g^2 - 2\,Hg\cos(\beta - G);\ \sin\gamma = \frac{g}{H_1}\sin(\beta - G);\ \beta_1 = \beta + \gamma.$$

M, v and r = the time of observation, true anomaly of the nucleus and its radius vector.

M_1, v_1 and r_1 = the time of emission of the particle, true anomaly and radius vector of the nucleus for this time.

β = the angle of the radius vector r_1 with the tangent.

H = velocity of the nucleus in the direction of the tangent for the time M_1.

$K = k\sqrt{\mu}$; k is the Gaussian constant.

V_1 = the angle between r_1 and the axis of the hyperbolic orbit of the particle.

t = the interval of time between the passage of the hyperbolic perihelion and the time of observation M.

E = eccentricity of the hyperbolic orbit.

P = semiparameter " "

ψ = the asymptotic angle to the hyberbola.

V = true hyperbolic anomaly of the particle for the time M.

R = hyperbolic radius vector of the particle.

ω = angle between the radius R and the axis of the parabolic orbit of the nucleus.

The position observations of the comets of 1880, and part of those of Comet *b*, 1881, were reduced by Mr. Egbert. All of the reductions have been made in duplicate by myself. Professor Stone has kindly assisted me by valuable suggestions.

H. C. WILSON,

Astronomer pro tem. of the Cincinnati Observatory.

Mt. Lookout, December, 1883.

POSITION OBSERVATIONS

OF

COMETS,

1880-2.

Number.	Date.	Mt. Lookout Mean Time.	$\Delta\alpha$ Comet — *	Refraction.	$\Delta\delta$ Comet — *	Refraction.	No. of Comparisons.
	1880	h. m. s.	m. s.	s.	′ ″	″	
1	October 7	7 30 46	—0 47.59	...	...	...	11
2	... 7	7 32 31	...	...	−6 55.5	...	4
3	... 8	7 21 56	...	...	—1 12.8	0.0	3
4	... 8	7 44 18	—1 20.47	0.00	...	...	11
5	... 8	7 53 58	+0 11.28	...	...	...	10
6	... 8	8 16 42	...	...	—1 0.3	0.0	7
7	... 9	7 28 56	...	...	—3 52.4	−0.1	9
8	... 9	7 33 21	+0 11 20	0.00	...	...	20
9	... 12	8 12 34	+1 17.06	0.00	...	...	10
10	... 12	8 15 48	...	...	—0 46.2	0.0	11
11	... 12	8 56 25	+1 29.58	—0.01	...	...	10
12	... 13	7 21 55	...	...	—0 21.4	0.0	10
13	... 13	7 29 36	—0 25.46	...	...	...	20
14	... 21	6 57 58	...	...	—0 45.4	0.0	13
15	... 21	7 15 0	+1 21.68	0.00	...	...	20
16	November 2	6 39 9	...	...	—0 22.4	0.0	10
17	... 2	6 50 40	+1 1.22	0.00	...	...	20
		Comet f, 1880.					
18	December 18	6 27 58	—0 38.42	—0.03	...	...	20
19	... 18	6 29 5	...	...	—4 10.8	—0.4	10
20	... 31	7 7 31	...	...	+0 19.8	0.0	3
21	... 31	7 7 31	...	...	—0 43.4	−0.1	3
22	... 31	7 25 13	+3 5.52	0.00	...	...	4
23	... 31	7 25 13	—0 44.80	—0.01	...	...	4
24	... 31	7 27 31	...	...	—0 1.65	0.0	4
25	... 31	7 32 0	—0 3.20	0.00	...	...	10

Number.	Apparent R. A.	Parallax.	Apparent Decl.	Parallax.	Observer.	Comparison Star.	Notes.
	h. m. s.	s.	° ′ ″	″			
1	16 20 46.1	+0.63	...	...	S	1	
2	...	...	+23 34.3	+5.5	S	1	
3	...	...	22 40 2.8	+5.4	S	2	
4	16 31 12.49	+0.64	...	...	S	2	
5	16 31 14.5	+0.65	...	...	S	3	
6	...	...	22 42.9	+5.6	S	3	
7	...	...	21 46 59.7	+5.5	S	4	
8	16 40 54.76	+0.61	...	...	S	4	
9	17 4 24.04	+0.55	...	...	S	5	
10	...	...	19 19 47.6	+5.4	S	5	
11	17 4 36.55	+0.58	...	...	L	5	
12	...	...	18 39.3	+4.7	E	6	Fainter, but possibly more condensed than hitherto.
13	17 11 55.8	+0.48	...	...	E	6	
14	...	...	14 1.4	+3.9	E	7	
15	17 49 4.5	+0.34	...	...	E	7	
16	...	...	9 58 39.2	+3.1	E	8	Very faint.
17	18 21 53.23	+0.19	...	...	E	8	
	Comet f, 1880.						
18	18 59 34.81	+0.29	...	...	E	9	Quite bright; round; condensed in center; no tail. W. notes times on chronometer.
19	...	...	+11 57 30.8	+3.3	E	9	
20	...	...	19 24.3	+3.0	S	10	
21	...	...	19 22.5	+3.0	S	12	
22	20 0 8.4	+0.29	...	...	S	10	W. notes times on chronometer.
23	20 0 10.5	+0.29	...	...	S	12	
24	...	...	19 24.2	+3.2	S	11	Double distance measured.
25	20 0 9.0	+0.29	...	...	S	11	

Number.	Date.	Mt. Lookout Mean Time.	Δα Comet — *	Refraction.	Δδ Comet — *	Refraction.	No. of Comparisons.
	1881	h. m. s.	m. s.	s.	′ ″	″	
26	June 23	15 9 8	...	...	+8 1.3	+2.6	2
27	... 23	15 29 15	−2 58.18	−0.02	...	—	4
28	... 23	15 31 34	+0 44.70	0.00	...	—	2
29	... 24	8 51 43	...	...	+8 25.0	+9.5	2
30	... 24	9 5 37	+2 28.24	+0.78	...	—	4
31	... 24	15 47 59	...	...	+1 55.1	+0.2	2
32	... 27	8 33 43	...	...	+7 29.4	+1.1	1
33	... 27	8 37 26	...	...	+7 42.0	+1.2	1
34	... 27	9 14 1	−1 5.84	+0.06	...	—	4
35	... 27	9 14 1	−1 10.20	0.00	...	—	4
36	... 27	9 15 17	+0 27.98	+0.06	...	—	2
37	... 27	9 24 9	...	...	+0 23.0	+0.1	2
38	... 27	12 38 37	+1 15.20	0.00	...	—	8
39	... 27	12 40 15	...	...	−0 18.7	0.0	4
40	July 1	11 10 16	−1 0.71	0.00	...	—	8
41	... 1	11 11 6	...	...	−1 33.9	−0.1	4
42	... 2	10 58 58	+2 55.37	0.00	...	—	4
43	... 2	11 0 57	...	...	+0 28.5	+0.1	2
44	... 3	15 32 18	+6 41.60	+0.06	...	—	4
45	... 3	15 33 42	...	...	+4 52.8	+0.2	3
46	... 4	11 36 47	+5 51.01	−0.01	...	—	4
47	... 4	11 36 47	+5 50.73	+0.01	...	—	4
48	... 4	11 43 31	...	...	−3 26.9	−0.3	3
49	... 5	10 50 17	−0 51.89	...	...	—	7
50	... 5	10 50 17	−0 47 55	...	...	—	7
51	... 5	10 50 48	...	...	+0 36.6	—	4
52	... 7	10 9 54	...	...	−1 20.3	−0.1	4
53	... 7	10 10 36	+1 57.16	+0.02	...	—	8
54	... 8	10 55 4	+1 14.21	...	...	—	5
55	... 8	10 55 4	+1 17.27	...	...	—	6

Number.	Apparent R. A.			Parallax.	Apparent Decl.			Parallax.	Observer.	Comparison Star.	Notes.
	h.	m.	s.	s.	°	′	″	″			
26		...		...	+46	48	34.7	+22.1	S	13	Nucleus bright and well defined.
27	5	36	23.99	−1.93		...		...	S	13	W. notes times on chronometer.
28	5	36	24.28	−1.95		...		...	S	14	
29		...		...	49	54	51.2	+25.4	E	15	W. notes times on chronometer.
30	5	39	11.71	+1.32		...		...	E	15	
31		...		...	51	0	9.1	+18.8	S	16	
32		...		...	60	34	22.3	+20.1	S	17	W. notes times on chronometer.
33		...		...	60	34	51.5	+20.3	S	18	
34	5	53	35.54	+1.46		...		...	S	18	
35	5	53	35.44	+1.47		...		...	S	19	
36	5	53	35.64	+1.47		...		...	S	17	
37		...		...	60	40	50.2	+22.4	S	19	
38		...		...		...		...	W	20	S. notes times on chronometer.
39		...		...		..		...	W	20	
40	6	22	22.27	+0.47		...		...	W	21	
41		...		...	70	33	56.7	+19.6	W	21	
42	6	32	0.06	+0.71		...		...	S	22	
43		...		...	72	27	47.2	+18.3	S	22	
44	6	45	29.31	−2.90		...		...	S	23	
45		...		...	74	20	50.7	+11.6	S	23	
46	6	54	6.17	+0.40		...		...	S	24	
47	6	54	6.52	+0.40		...		...	S	25	
48		...		...	75	30	51.8	+16.7	S	25	
49		...		...		...		...	S	26	
50	7	6	16	+1.34		...		...	S	27	
51		...		...	76	42.1		+15.1	S	27	
52		...		...	78	41.8		+12.2	S	28	
53	7	34	28	+2.45		...		...	S	28	
54		...		...		...		...	W	29	
55		...		...		...		...	W	30	

Number.	Date.		Mt. London Mean Time.			$\Delta\alpha$ Comet — *		Refraction.	$\Delta\delta$ Comet — *		Refraction.	No. of Comparisons.
	1881		h.	m.	s.	m.	s.	s.	′	″	″	
56	July	8	10	55	39		—	—	+0	43.8	—	6
57	...	8	10	55	21		...	—	−4	15.1	...	2
58	...	8	11	1	36		...	—	−0	56.9	...	5
59	...	8	11	11	54	+0	38.75	—		—	...	10
60	...	8	11	21	51		..	...	−0	33.6	0.0	2
61	...	8	11	37	8	−2	58.65	+0.01		—	..	4
62	...	9	9	31	36		...	...	+0	13.9	...	2
63	...	9	9	37	53	−1	22.49	...		...	...	8
64	...	9	9	37	53	−6	7.26	...		...	...	8
65	...	9	9	38	50		...	...	+1	4.8	...	3
66	...	12	9	5	10	+0	30.00	...		...	...	6
67	...	12	9	6	33		...	...	+0	7.4	...	4
68	...	13	9	37	44		...	...	+1	4.0	0.0	6
69	...	13	9	38	23	+2	0.58	−0.06		...	...	6
70	...	13	10	38	8		...	...	+1	33.0	0.0	3
71	...	13	10	41	34	+2	52.09	−0.07		...	...	8
72	...	15	9	38	37	−2	41.75	+0.15		...	...	6
73	...	15	9	40	36		...	...	−5	48.6	−0.2	6
74	...	18	8	40	45	−0	51.15	−0.16		...	...	6
75	...	18	8	40	52		...	...	−2	22.0	0.0	4
76	August	1	12	21	42		...	..	−2	34.0	−0.1	9
77	...	1	12	40	45	+1	20.00	+0.09		...	...	12
78	...	1	12	48	23	−2	41.34	+0.19		...	...	5
79	...	1	13	24	6		...	...	−5	17.9	−0.2	4
80	...	3	10	21	28		...	...	−11	35.3	−0.2	3
81	...	3	10	37	53	−0	22.60	+0.48		...	...	6
82	...	3	10	50	7	+3	30.20	+0.22		...	...	6
83	...	3	11	12	4		...	...	−5	25.5	−0.1	3
84	...	5	10	28	36		...	...	−4	25.9	−0.1	7
85	...	5	10	30	25	+2	14.51	+0.18		...	...	18

Number.	Apparent R. A.	Parallax.	Apparent Decl.	Parallax.	Observer.	Comparison Star.	Notes.
	h. m. s.	s.	° ′ ″	″			
56	...	...	...	...	W	29	
57	...	...	...	...	W	30	
58	...	...	...	...	W	31	
59	...	...	...	...	W	31	
60	...	...	+79 33 3.2	+13.1	W	32	
61	7 51 33.78	+1.20	...	...	W	32	
62	...	...	...	...	S	33	
63	...	...	...	...	S	33	
64	...	...	...	...	S	34	
65	...	...	...	...	S	34	
66	...	...	...	...	S	35	
67	...	...	...	...	S	35	
68	...	...	81 52 0.0	+5.7	W	36	
69	9 21 59.64	+4.36	...	...	W	36	
70	...	...	81 52 29.0	+7.9	S	36	
71	9 22 51.14	+3.62	...	...	S	36	
72	9 59 35.05	...	...	...	W	37	
73	...	...	82 12 6.8	...	W	37	W. notes times on chronometer.
74	10 50 2.72	+4.47	...	...	W	38	
75	...	...	82 16 38.3	+0.2	W	38	
76	...	...	...	...	L	39	
77	...	...	...	...	L	39	
78	13 8 13.30	+2.03	...	...	L	40	
79	...	...	80 11 40.4	+5.4	L	40	
80	...	...	79 52.3	+0.8	E	42	
81	13 18 51	+2.44	...	...	E	42	
82	13 18 52.2	+2.43	...	...	E	41	
83	...	...	79 51.3	+2.2	E	41	
84	...	...	79 31 26.4	+0.9	L	43	Faint in moonlight; tail scarcely visible; coma very large.
85	13 29 9.08	+2.28	...	...	L	43	

Number.	Date.	Mt. Lookout Mean Time.	Δα Comet − *	Refraction.	Δδ Comet − *	Refraction.	No. of Comparisons.
	1881	h. m. s.	m. s.	s.	′ ″	″	
86	August 5	11 17 10	+2 42.50	−0.44	...	...	4
87	... 5	11 37 26	...	...	+11 49.2	+0.3	2
88	... 9	10 51 25	...	...	+4 13.6	+0.1	4
89	... 9	10 51 25	...	...	−0 12.4	0.0	4
90	... 9	10 51 25	...	...	−6 50.3	−0.2	4
91	... 9	10 58 5	...	...	−6 57.7	−0.2	3
92	... 9	11 33 0	−7 31.19	+0.27	...	...	3
93	... 9	11 33 0	−7 31.83	+0.28	...	...	3
94	... 9	11 39 0	−1 28.10	−0.12	...	...	4
95	... 9	11 39 0	−1 50.03	0.00	...	...	4
96	... 10	10 16 25	+9 42.65	−0.09	...	...	6
97	... 10	10 54 55	...	...	+3 7.5	+0.1	3
98	... 11	10 18 51	+13 52.54	+0.26	...	...	2
99	... 11	10 57 6	−0 39.73	+0.11	...	...	12
100	... 11	11 4 46	+2 25.01	−0.02	...	...	10
101	... 11	11 5 42	...	...	−6 8.1	−0.2	1
102	... 11	11 25 1	...	...	−3 35.9	−0.1	7
103	... 11	11 25 1	...	...	+0 48.6	0.0	7
104	... 15	12 6 26	+2 56.61	+0.25	...	....	12
105	... 15	12 23 25	...	...	−9 10.8	−0.3	6
106	... 16	10 18 20	...	...	−16 55.5	−0.3	5
107	... 16	10 41 3	+6 31.73	+0.49	...	...	10
108	... 22	12 37 29	+6 36.18	+0.11	...	...	4
109	... 22	12 39 30	−3 39.30	+0.14	...	...	4
110	... 22	13 10 28	...	...	−7 33.8	−0.3	2
111	... 22	13 17 28	...	...	−5 31.6	−0.2	2
112	... 24	8 47 19	...	...	+3 16.1	...	4
113	... 24	8 47 19	...	...	+3 16.1	...	4
114	... 24	8 47 19	...	...	−4 30.3	−0.1	4
115	... 24	8 47 19	...	...	−0 35.6	...	4

Number.	Apparent R. A.	Parallax.	Apparent Decl.	Parallax.	Observer.	Comparison Star.	Notes.
	h. m. s.	s.	° ′ ″	″			
86	13 29 22.89	+2.23	...	...	L	44	
87	...	...	+79 31 5.0	+2.7	L	44	
88	...	...	78 52 8.7	+2.9	L	45	
89	...	...	...	...	L	46	
90	...	...	78 52 4.4	+2.8	L	47	
91	...	...	...	...	L	48	
92	13 47 44.63	+2.02	...	...	L	47	
93	...	...	...	...	L	48	
94	13 47 45.75	+2.01	...	...	L	45	
95	...	...	...	...	L	46	
96	13 52 49.68	+1.98	...	...	E	49	
97	...	...	78 42 46.3	+1.5	E	49	
98	13 55 59.91	+1.94	...	...	L	49	
99	13 55 59	+1.90	...	...	L	51	
100	13 55 52	+1.89	...	...	L	50	
101	...	...	78 33 30.4	+1.8	L	49	
102	...	...	78 30.7	+2.5	L	51	
103	...	...	78 30.6	+2.5	L	50	
104	14 12 13.98	+1.28	...	...	L	52	
105	...	...	77 57 17.1	+3.4	L	52	
106	...	...	77 49 32.4	+0.6	E	52	Comet compared directly with 9.5 magnitude star, and this star compared with star (52).
107	14 15 49.34	+1.70	...	...	E	52	
108	14 38 34.86	+1.29	...	...	L	53	
109	...	...	...	...	L	54	
110	...	...	...	...	L	54	
111	...	...	76 59 48.9	+5.8	L	53	
112	...	...	...	...	E	55	
113	...	...	...	...	E	56	
114	...	...	76 46 14.0	...	E	57	
115	...	...	...	...	E	58	

Number.	Date.	Mt. Lookout Mean Time.	Δα Comet — *	Refraction.	Δδ Comet — *	Refraction.	No. of Comparisons.
	1881	h. m. s.	m. s.	s.	′ ″	″	
116	August 24	9 13 30	+0 18.34	...	...	...	7
117	... 24	9 13 30	−0 9.03	...	...	...	7
118	... 24	9 13 30	−3 6.70	+0.05	...	...	7
119	... 24	9 13 30	−3 36.66	...	...	...	7
120	September 6	10 49 13	+0 14.95	...	...	...	10
121	... 6	11 10 38	...	...	−3 34.0	...	5
122	... 12	11 45 13	−0 50.31	0.00	...	...	6
123	... 12	11 45 13	−1 12.27	0.00	...	...	6
124	... 12	11 46 0	...	...	−0 15.2	0.0	4
125	... 12	11 46 0	...	...	+1 13.6	0.0	4
126	... 21	10 2 56	+0 56.75	0.00	...	...	12
127	... 21	10 8 50	...	...	−0 29.6	0.0	10
128	October 14	10 31 43	−0 37.84	+0.11	−9 42.8	−0.2	6
			Comet c, 1881.				
129	July 17	14 58 46	+0 12.00	+0.03	...	...	10
130	... 17	14 58 46	+0 6.81	0.00	...	...	10
131	... 17	14 58 52	...	...	−3 55.5	−0.5	4
132	... 17	15 23 59	...	...	+0 39.9	+0.1	3
133	... 18	15 33 1	+1 21.22	+0.03	...	...	6
134	... 18	15 38 36	...	...	−2 9.8	−0.4	5
135	... 19	14 33 16	−2 32.73	+0.02	...	...	6
136	... 19	14 32 20	...	...	−1 2.5	−0.3	6
137	... 22	15 24 57	+2 26.36	−0.02	...	...	8
138	... 22	15 35 6	...	...	+0 44.8	+0.4	5
139	... 24	14 20 4	−1 7.75	...	...	...	4
140	... 24	15 3 4	+0 22.68	+0.02	...	...	8
141	... 24	15 3 4	−0 23.58	0.00	...	...	8
142	... 24	15 3 4	−1 52.06	0.00	...	...	8

Number.	Apparent R. A.	Parallax.	Apparent Decl.	Parallax.	Observer	Comparison Star.	Notes.
	h. m. s.	s.	° ′ ″	″			
116	...	...	...	...	E	55	
117	...	...	...	...	E	56	
118	14 45 19.91	...	...	...	E	57	
119	...	...	...	...	E	58	
120	...	...	...	...	L	59	Very faint in moonlight.
121	...	...	...	...	L	59	
122	15 56 9	+1.02	...	...	W	60	
123	15 56 9	+1.02	...	...	W	61	
124	...	...	+74 36.5	+9.0	W	60	
125	...	...	74 36.5	+9.0	W	61	
126	16 30 58.64	+0.96	...	...	W	62	Nucleus bright but small. W. notes times on chronometer.
127	...	...	73 39 28.7	+0.6	W	62	Very faint. Observed with ring micrometer. J. notes times on chronometer.
128	18 5 8.45	+0.74	70 57 37.6	+1.0	W	63	
	Comet c, 1881.						
129	5 51 11.70	−0.34	...	...	S	64	Nucleus bright.
130	...	...	...	...	S	65	
131	...	...	+39 57 10.0	+3.3	S	64	
132	...	...	39 57.5	+3.0	S	66	
133	5 53 13	−0.36	...	...	S	67	
134	...	..	40 19.2	+2.9	S	67	
135	5 55 2.35	−0.35	...	...	W	68	
136	...	...	40 40 29.5	+3.7	W	68	
137	6 1 27.15	−0.40	...	...	S	69	Observed in dawn. Nucleus still quite plainly visible.
138	...	...	41 52 31.6	+3.0	S	69	
139	...	...	...	...	S	70	Comet faint.
140	6 6 19.67	−0.42	...	...	S	71	
141	...	...	...	...	S	72	
142	6 6 20.11	−0.42	...	...	S	73	

Number.	Date.	Mt. Lookout Mean Time.	Δα Comet — *	Refraction.	Δδ Comet — *	Refraction.	No. of Comparisons.
	1881	h. m. s.	m. s.	s.	′ ″	″	
143	July 24	15 21 31	...	...	6 16.2	—0.4	1
144	... 24	15 26 6	...	...	−0 46.5	0.0	2
145	... 24	15 31 12	...	...	—0 13.5	0.0	4
146	... 24	15 31 12	...	...	−0 11.6	0.0	4
147	... 24	15 46 4	−3 4.29	0.00	...	...	4
148	... 24	15 58 40	−0 15.5	...	...	...	1
149	... 24	16 0 1	+0 28.92	+0.02	...	...	4
150	... 24	16 0 1	−1 45.73	0.00	...	...	4
151	... 24	16 0 46	−3 2.54	0.00	...	...	3
152	... 25	15 5 40	...	...	+1 33.0	+0.1	2
153	... 25	15 17 2	+7 56.65	0.00	...	...	2
154	... 25	15 27 33	...	...	—0 21.6	0.0	4
155	... 25	15 28 16	+6 7.69	0.00	...	...	8
156	... 25	15 31 49	+1 31.13	0.00	...	...	6
157	... 25	15 31 49	+0 49.98	0.00	...	...	6
158	... 26	15 3 49	...	...	+1 39.0	0.0	5
159	... 26	15 15 53	...	...	+3 52.2	+0.1	2
160	... 26	16 10 1	−1 48.75	−0.01	...	...	5
161	... 26	16 12 15	−4 7.01	0.00	...	...	3
162	... 27	15 12 39	+1 41.20	0.00	...	...	16
163	... 27	15 15 45	...	...	+0 23.6	0.0	11
164	August 1	14 38 29	+1 4.18	0.00	...	...	10
165	... 1	14 38 29	+0 9.17	0.00	...	...	10
166	... 1	14 38 45	+0 41.90	0.00	...	...	9
167	... 1	14 39 24	+0 51.58	0.00	...	...	8
168	... 1	15 4 38	...	...	−9 3.4	—0.4	3
169	... 1	15 4 38	...	...	—4 55.3	−0.1	3
170	... 1	15 8 11	...	...	—9 29.5	—0.4	3
171	... 1	15 8 11	...	...	—8 22.6	—0.3	3
172	... 1	15 35 42	...	...	—3 39.2	—0.2	1

Number.	Apparent R. A.			Parallax.	Apparent Decl.			Parallax.	Observer.	Comparison Star.	Notes.
	h.	m.	s.	s.	°	′	″	″			
143		...		...	+42	43	30.9	+3.2	S	71	
144		...		...	42	43	40.2	+3.2	S	74	
145		...		...		...		...	S	72	
146		...		...	42	43	44.4	+3.1	S	73	
147	6	6	24.23	—0.43		...		...	S	74	
148		...		...		...		...	L	72	
149	6	6	25.91	—0.43		...		...	L	71	
150	6	6	26.44	—0.43		...		...	L	73	
151	6	6	25.98	—0.43		...		...	L	74	Clouds.
152		...		...	43	10.5		+3.5	S	75	
153	6	9	4.04	—0.44		...		...	S	76	
154		...		...	43	10	35.7	+3.2	S	77	
155	6	9	5.24	—0.44		...		...	S	77	
156	6	9	4	—0.44		...		...	S	75	
157	6	9	5	—0.44		...		...	S	78	
158		...		...	43	38	3.2	+3.6	L	79	
159		...		...	43	38	16.0	+3.4	L	80	
160	6	12	5.18	—0.46		...		...	L	80	The transits were taken in the dawn.
161	6	12	5.46	—0.46		...		...	L	79	
162	6	15	5.66	—0.47		...		...	L	81	Comet almost round.
163		...		...	44	6	55.6	+3.2	L	81	
164	6	34	59	—0.52		...		...	E	82	Nucleus bright = 4½ m.
165		...		...		...		...	E	83	
166		...		...		...		...	E	84	
167	6	34	59	—0.52		...		...	E	85	
168		...		...	46	43.6		+4.1	E	82	
169		...		...	46	44.2		+4.1	E	85	
170		...		...		...		...	E	84	
171		...		...		...		...	E	83	
172		...		...	46	45	6.6	+3.5	E	86	

Number.	Date.	Mt. Lookout Mean Time.	$\Delta\alpha$ Comet — *	Refraction.	$\Delta\delta$ Comet — *	Refraction.	No. of Comparisons.
	1880	h. m. s.	m. s.	s.	′ ″	″	
173	August 1	15 38 21	...	...	+5 19.7	+0.2	1
174	... 1	15 44 13	−1 33.08	0.00	...	...	2
175	... 1	15 44 13	−2 19.26	0.00	...	...	2
176	... 5	15 35 45	...	...	−7 38.5	−0.3	5
177	... 5	15 35 45	...	...	+2 3.4	+0.1	5
178	... 5	15 57 58	+0 45.25	0.00	...	...	10
179	... 5	15 57 58	−0 31.59	0.00	...	...	10
180	... 10	16 15 12	...	...	+2 57.8	+0.1	6
181	... 10	16 15 35	+1 8.84	0.00	...	...	10
182	... 14	15 59 36	...	...	−2 58.5	−0.1	5
183	... 14	16 4 18	+4 13.99	0.00	...	...	10
184	... 14	16 16 4	−0 52.30	0.00	...	...	4
185	... 14	16 33 56	...	...	+1 36.6	0.0	2
186	... 16	8 23 32	...	...	+3 45.7	+1.0	5
187	... 16	8 50 35	−3 24.35	+0.07	...	...	10
188	... 16	9 21 57	−2 58.12	+0.07	...	...	8
	Comet d, 1881.						
189	September 21	13 15 48	+3 35.13	0.00	...	...	6
190	... 21	13 17 35	...	...	+2 18.4	+0.1	8
191	... 24	11 1 55	−0 41.55	−0.09	+9 49.9	+1.5	4
192	... 24	11 17 48	−0 36.72	−0.06	+9 49.4	+1.0	2
	Comet e, 1881.						
193	September 23	7 27 8	...	...	−0 11.9	0.0	2

Number.	Apparent R. A.	Parallax.	Apparent Decl.	Parallax.	Observer.	Comparison Star.	Notes.
	h. m. s.	s.	° ′ ″	″			
173	...	...	+46 45.0	+3.5	E	87	
174	6 35 12.57	−0.55	...	...	E	86	
175	6 35 14	−0.55	...	...	E	87	
176	...	...	49 4.3	+4.0	E	88	
177	...	...	49 5.2	+4.0	E	89	
178	6 59 20	−0.68	...	...	E	88	
179	6 59 23	−0.68	...	...	E	89	
180	...	...	51 58 39.6	+4.2	L	90	
181	7 43 32.69	−0.86	...	...	L	90	Appeared very dim.
182	...	...	52 46 52.1	+6.9	L	91	
183	8 48 43.01	−0.98	...	...	L	91	
184	8 48 52.02	−1.00	...	...	L	92	
185	...	...	52 46 45.1	+5.8	L	92	Comet quite bright.
186	...	...	52 16 40.6	+10.3	E	93	
187	9 21 30.98	+0.72	...	...	E	93	
188	9 21 57.21	+0.77	...	...	J	93	
	Comet d, 1881.						
189	6 16 27.13	−0.84	...	...	W	95	No nucleus. Very faint. W. notes times on chronometer.
190	...	...	+42 25 37.3	+3.9	W	95	Ring micrometer used. J. notes times on chronometer.
191	6 43 29.35	−0.88	42 55 10.2	+8.6	W	96	
192	6 43 34.20	−0.90	42 55 9.3	+8.9	J	96	Ring micrometer used. W. notes times on chron.
	Comet e, 1881.						
193	...	...	+7 8 39.8	+4.1	W	94	Disappeared in a cloud.

Number.	Date.	Mt. Lookout Mean Time.	$\Delta\alpha$ Comet — *	Refraction.	$\Delta\delta$ Comet — *	Refraction.	No. of Comparisons.
	1882	h. m. s.	m. s.	s.	′ ″	″	
194	March 24	13 41 25	...	...	−4 24.4	−0.1	6
195	... 24	13 51 30	+0 24.09	0.00	...	...	10
196	... 24	13 51 30	−0 32.79	0.00	...	...	10
197	... 24	14 13 1	...	...	−8 2.3	−0.1	1
198	... 28	15 12 4	+1 44.44	0.00	...	...	12
199	... 28	15 12 34	...	...	−0 26.9	0.0	8
200	... 28	15 34 24	...	...	−2 32.2	0.0	4
201	... 28	15 48 8	+0 9.07	0.00	...	...	6
202	April 12	11 41 54	+0 15.97	+0.01	...	...	12
203	... 12	11 42 6	...	...	+3 55.4	+0.1	8
204	... 14	12 59 44	...	...	−2 48.0	0.0	7
205	... 14	13 5 40	+3 8.52	0.00	...	...	6
206	... 14	13 7 56	+0 46.85	0.00	...	...	4
207	... 14	13 8 58	...	...	−2 20.5	0.0	5
208	... 17	14 22 47	...	...	+6 5.8	...	5
209	... 17	14 22 47	...	...	+6 8.1	...	5
210	... 17	14 27 39	−0 9.67	...	...	...	7
211	... 17	14 27 39	−2 0.66	...	...	...	8
212	... 20	12 4 22	−2 51.12	+0.02	...	...	8
213	... 20	12 5 20	...	...	+5 45.0	+0.1	6
214	... 23	12 52 19	...	...	+8 33.8	+0.1	4
215	... 23	12 52 26	+2 24.50	+0.03	...	...	6
216	... 23	12 52 40	+0 22.28	...	...	...	6
217	... 23	12 55 30	...	...	+3 23.8	...	8
218	... 24	12 43 33	+0 21.20	+0.02	...	...	10
219	... 24	12 45 1	...	...	+3 38.6	+0.1	6
220	... 27	10 28 18	...	...	+0 35.64	...	7
221	... 27	10 30 32	+1 25.35	...	...	...	12
222	... 29	10 20 6	...	...	+3 10.5	...	8
223	... 29	10 20 10	+0 10.86	...	...	...	10

Number.	Apparent R. A.			Parallax.	Apparent Decl.			Parallax.	Observer.	Comparison Star.	Notes.
	h.	m.	s.	s.	°	′	″	″			
194		...		...	+36	14	19.8	+1.5	W	97	Nucleus stellar.
195	18	3	25.08	—0.30		...		...	W	97	W. notes times on chronometer.
196	18	3	25.69	—0.30		...		...	W	98	
197		...		...	36	15	14.0	+1.3	W	98	
198	18	10	54.42	—0.24		...		...	W	99	W. notes time on chronometer.
199		...		...	38	43	47.0	+0.6	W	99	
200		...		...		...		...	W	100	
201		...		...		...		...	W	100	
202		...		...		...		...	W	101	
203		...		...		...		...	W	101	
204		...		...	51	51	52.5	+0.8	W	102	
205	18	52	45.19	—0.54		...		...	W	102	W. notes times on chronometer.
206		...		...		...		...	W	103	
207		...		...		...		...	W	103	
208		...		...		...		...	W	104	
209		...		...		...		...	W	105	
210		...		...		...		...	W	104	W. notes times on chronometer.
211		...		...		...		...	W	105	
212	19	16	26.27	—0.74		...		...	W	106	W. notes times on chronometer.
213		...		...	57	37	54.8	+1.6	W	106	
214		...		...	60	45	16.0	+0.4	W	107	
215	19	32	28.76	—0.80		...		...	W	107	
216		...		...		...		...	W	108	
217		...		...		...		...	W	108	
218	19	38	34.67	—0.85		...		...	W	109	Windy.
219		...		...	61	47	40.2	+0.6	W	109	
220		...		...		...		...	W	110	Times recorded on Morse Register.
221		...		...		...		...	W	110	
222		...		...		...		...	W	111	Hazy and moonlight.
223		...		...		...		...	W	111	Times recorded on Morse Register.

Number.	Date.	Mt. Lookout Mean Time.	Δα Comet — *	Refraction.	Δδ Comet — *	Refraction.	No. of Comparisons.
	1882	h. m. s.	m. s.	s.	′ ″	″	
224	May 8	10 24 5	−2 52.20	−0.09	...	...	6
225	... 8	10 24 5	−0 20.93	−0.17	...	...	4
226	... 8	10 25 5	...	...	+ 8 29.4	−0.4	4
227	... 8	10 25 5	...	...	+15 15.9	−0.8	2
228	... 15	11 44 47	...	...	+10 29.7	+1.0	4
229	... 15	11 46 58	+3 54.12	+0.04	...	...	6
230	... 16	9 47 29	−1 52.18	0.00	...	...	6
231	... 16	9 48 18	...	...	− 3 19.7	−0.3	6
232	... 18	9 51 47	+3 54.38	0.00	...	...	6
233	... 18	9 51 51	...	...	− 2 48.0	−0.4	6
234	... 18	10 55 51	...	...	+ 1 9.6	+0.2	3
235	... 18	11 16 49	+0 18.62	0.00	...	...	10
236	... 22	10 38 18	...	...	− 2 13.0	−0.6	6
237	... 22	10 49 54	+4 16.13	0.00	...	...	10
		Comet c, 1882.					
238	October 4	16 52 54	...	...	+12 11.5	+4.0	1
239	... 4	17 3 57	+0 10.08	−0.19	...	...	9
240	...	...	10.49	−0.19	...	...	9
241	... 5	17 2 53	...	...	+ 3 46.6	+0.8	4
242	... 5	17 3 48	−1 11.82	−0.05	...	...	6
243	...	...	11.40	−0.05	...	...	6
244	...	...	11.00	−0.05	...	...	6
245	... 6	17 23 30	...	...	+10 7.4	+1.2	6
246	... 6	17 23 37	+0 31.73	−0.06	...	...	12
247	...	...	32.23	−0.06	...	...	12
248	...	...	32.79	−0.06	...	...	12
249	...	...	33.09	−0.06	...	...	12
250	... 13	17 17 40	...	...	− 3 51.0	−0.8	1

Number.	Apparent R. A.			Parallax.	Apparent Decl.			Parallax.	Observer.	Comparison Star.	Notes.
	h.	m.	s.	s.	°	′	″	″			
224	22	42	17.09	—1.22		...		...	W	112	Comet faint in clouds. Times recorded on Morse Register.
225		...		...		...		...	W	113	
226		...		...	+74	10	58.1	+6.9	W	112	
227		...		...		...		...	W	113	
228		...		...	72	36	44.7	+8.4	W	114	W. notes times on chronometer.
229	1	33	1.09	—0.78		...		...	W	114	
230	1	51	31.20	+0.18		...		...	W	115	W. notes times on chronometer.
231		...		...	71	47	35.7	+9.2	W	115	
232	2	26	43.33	+0.33		...		...	W	116	W. notes times on chronometer.
233		...		...	69	38	32.9	+9.2	W	116	
234		...		...		...		...	W	117	
235		...		...		...		...	W	117	Time recorded on Morse Register.
236		...		...	64	7	29.9	+9.6	W	118	W. notes times on chronometer.
237	3	18	44.21	+0.13		...		...	W	118	
					Comet c, 1882.						
238		...		...	— 8	52	37.4	+4.3	W	119	Nucleus 2.
239	10	34	5.85	—0.32		...		...	W	119	Nucleus 1.
240			6.26	—0.32		...		...	W	119	Nucleus 2.
241		...		...	— 9	20	34.5	+4.4	W	120	n_2
242	10	32	31.79	—0.32		...		...	W	120	n_1
243			32.21	—0.32		...		...	W	120	n_2
244			32.61	—0.32		...		...	W	120	n_3
245		...		...	— 9	47	44.9	+4.4	W	121	n_2
246	10	30	59.01	—0.30		...		...	W	121	n_0
247			59.51	—0.30		...		...	W	121	n_1
248		31	0.07	—0.30		...		...	W	121	n_2
249			0.37	—0.30		...		...	W	121	n_3
250		...		...	—12	47	31.3	+4.5	W	122	n_2

Number.	Date.	Mt. Lookout Mean Time.	Δα Comet — *	Refraction.	Δδ Comet — *	Refraction.	No. of Comparisons.
	1882	h. m. s.	m. s.	s.	′ ″	″	
251	October 13	17 33 38	...	...	−0 43.2	−0.1	4
252	... 13	17 34 7	+3 36.63	0.00	...	...	6
253	...	...	37.78	0.00	...	...	6
254	...	...	38.23	0.00	...	...	6
255	...	...	38.68	0.00	...	...	6
256	... 13	17 34 7	+2 56.60	+0.05	...	...	6
257	...	...	57.75	+0.05	...	...	6
258	...	...	58.20	+0.05	...	...	6
259	...	...	58.65	+0.05	...	...	6
260	... 19	17 30 49	+2 15.09	−0.01	...	...	4
261	...	...	15.64	−0.01	...	...	4
262	... 19	17 31 40	...	...	+5 2.1	+0.4	4
263	... 20	16 58 30	...	...	−1 33.2	−0.2	4
264	... 20	17 4 37	+1 17.64	+0.01	...	...	8
265	...	...	18.17	+0.01	...	...	8
266	... 29	16 6 49	...	...	−6 15.9	−0.9	4
267	... 29	16 6 49	...	...	−7 57.8	0.9	4
268	... 29	16 8 10	+0 21.59	+0.05	...	...	14
269	...	...	22.41	+0.05	...	...	14
270	... 29	16 8 10	+0 13.96	+0.06	...	...	14
271	...	...	14.78	+0.06	...	...	14
272	November 2	17 1 9	...	...	+10 45.0	+0.9	3
273	... 2	17 14 1	...	...	−0 59.1	−0.1	6
274	... 2	17 17 0	+0 22.00	−0.03	...	...	12
275	...	...	22.82	−0 03	...	...	12
276	...	...	23.60	−0.03	...	...	12
277	... 2	17 17 0	−0 20.99	+0.02	...	...	12
278	...	...	20.16	+0.02	...	...	12
279	...	...	19.38	+0.02	...	...	12
280	... 3	16 43 41	...	...	−5 31.5	−0.5	4

Number.	Apparent R. A.			Parallax.	Apparent Decl.			Parallax.	Observer.	Comparison Star.	Notes.
	h.	m.	s.	s.	°	′	″	″			
251		...		...	—12	47	42.5	+4.6	W	123	n_2
252	10	21	11.28	—0.25		...		...	W	123	n_0
253			12.43	—0.25		...		...	W	123	n_1
254			12.88	—0.25		...		...	W	123	n_2
255			13.33	—0.25		...		...	W	123	n_3
256	10	21	10.49	—0.25		...		...	W	122	n_0
257			11.64	—0.25		...		...	W	122	n_1
258			12.09	—0.25		...		...	W	122	n_2
259			12.54	—0.25		...		...	W	122	n_3
260		...		—0.22		...		...	W	124	n_1
261		...		—0.22		...		...	W	124	n_2
262		...		...		...		+4.6	W	124	n_2
263		...		...	—15	35	1.1	+4.6	W	125	n_2
264	10	11	54.66	—0.24		...		...	W	125	n_1
265			55.19	—0.24		...		...	W	125	n_2
266		...		...	—18	58	36.1	+4.6	W	126	n_2
267		...		...	—18	58	30.3	+4.6	W	127	n_2
268	9	59	7.29	—0.25		...		...	W	126	n_1
269			8.11	—0.25		...		...	W	126	n_2
270	9	59	7.24	—0.25		...		...	W	127	n_1
271			8.06	—0.25		...		...	W	127	n_2
272		...		...	—20	26	30.8	+4.9	W	128	n_2 Slightly hazy.
273		...		...		...		+5.0	W	129	n_2
274	9	52	40.34	—0.15		...		...	W	128	n_1
275			41.16	—0.15		...		...	W	128	n_2
276			41.94	—0.15		...		...	W	128	n_3
277		...		...		...		...	W	129	n_1
278		...		...		...		...	W	129	n_2
279		...		...		...		...	W	129	n_3
280		...		...	—20	47	23.4	+4.9	W	130	n_2

Number.	Date.	Mt. Lookout Mean Time.	Δα Comet — *	Refraction.	Δδ Comet — *	Refraction.	No. of Comparisons.
	1882	h. m. s.	m. s.	s.	′ ″	″	
281	November 3	16 45 27	−0 4.95	+0.02	...	...	10
282	...	...	3.08	+0.02	...	...	10
283	...	...	2.15	+0.02	...	...	10
284	...	...	1.37	+0.02	...	...	10
285	... 7	15 58 56	...	...	−5 5.6	−0.6	6
286	... 7	15 59 0	+0 49.18	+0.03	...	...	10
287	...	...	52.03	+0.03	...	...	10
288	...	...	53.03	+0.03	...	...	10
289	... 7	15 59 0	+1 3.15	...	...	...	10
290	...	...	6.00	...	...	...	10
291	...	...	7.00	...	...	...	10
292	... 20	17 42 21	...	...	+3 4.0	+0.3	2
293	... 20	17 53 54	+1 9.04	0.00	...	...	10
294	...	...	12.89	0.00	...	...	10
295	... 20	17 53 54	+1 11.41	0.00	...	...	8
296	...	...	15.26	0.00	...	...	8
297	... 29	17 25 52	...	...	−6 32.2	−0.8	4
298	... 29	17 37 51	−0 34.20	−0.02	...	...	3
299	... 29	17 37 51	−1 51.60	−0.02	...	...	3
300	December 11	13 28 43	...	...	+9 6.7	+1.4	2
301	... 11	13 43 52	−2 10.9	−0.03	...	...	2
	1883.						
302	January 31	8 51 6	...	...	+0 10.1	0.0	6
303	... 31	8 51 6	...	...	−1 40.1	−0.1	6
304	... 31	8 51 22	+0 35.17	0.00	...	...	10
305	... 31	8 51 22	−0 31.21	0.00	...	...	10
306	February 8	8 43 38	−0 2.76	0.00	...	...	20
307	...	...	+0 1.72	0.00	...	...	20
308	...	...	+0 7.07	0.00	...	...	20
309	... 8	8 55 1	...	...	−7 28.8	−0.5	5
310	... 28	9 29 33	...	...	−2 12.7	−0.1	6

Number.	Apparent R. A.			Parallax.	Apparent Decl.			Parallax.	Observer.	Comparison Star.	Notes.
	h.	m.	s.	s.	°	′	″	″			
281	9	51	0.26	−0.18		...		...	W	130	n_0
282			2.13	−0.18		...		...	W	130	n_1
283			3.06	−0.18		...		...	W	130	n_2
284			3.84	−0.18		...		...	W	130	n_3
285		...		...	−22	13	6.0	+4.8	W	131	n_2
286	9	44	0.30	−0.21		...		...	W	131	n_0
287			3.15	−0.21		...		...	W	131	n_1
288			4.15	−0.21		...		...	W	131	n_2
289		...		...		...		...	W	132	n_0
290		...		...		...		...	W	132	n_1
291		...		...		...		...	W	132	n_2
292		...		...	−26	18	19.8	+5.4	W	133	n_2
293	9	16	9.03	+0.06		...		...	W	133	n_0 Cloudy.
294			12.88	+0.06		...		...	W	133	n_2
295		...		...		...		...	W	134	n_0
296		...		...		...		...	W	134	n_2
297		...		...	−28	31	35.8	+5.3	W	135	n_2
298	8	52	27.31	+0.12		...		...	W	135	n_2
299	8	52	27.25	+0.12		...		...	W	136	n_2
300		...		...	30	16	21.8	+5.2	W	137	n_2 Very hazy.
301	8	16	37.6	−0.10		...		...	W	137	n_2
302		...		...	−22	11	12.8	+3.4	W	138	n_2
303		...		...	−22	11	11.6	+3.4	W	139	n_2
304	6	10	16.35	−0.03		...		...	W	138	n_2
305	6	10	16.33	−0.03		...		...	W	139	n_2
306	6	1	49.39	0.00		...		...	W	140	n_0 (?)
307			53.87	0.00		...		...	W	140	n_2 (?)
308			59.22	0.00		...		...	W	140	End of nucleus.
309		...		...	−20	3	13.7	+3.1	W	140	n_2 (?)
310		...		...	−15	14	47.6	+2.4	W	141	n_2 (?)

Number.	Date.	Mt. Lookout Mean Time.	$\Delta\alpha$ Comet — *	Refraction.	$\Delta\delta$ Comet — *	Refraction.	No. of Comparisons.
	1883	h. m. s.	m. s.	s.	′ ″	″	
311	February 28	9 31 26	+1 12.17	−0.01	...	...	10
312	March 2	9 4 8	−3 2.50	−0.01	...	...	6
313	... 2	9 4 22	...	...	−6 19.2	−0.4	6
314	... 3	8 53 53	...	...	−2 24.4	−0.1	6
315	... 3	8 55 2	+0 6.01	0.00	...	...	10
316	... 3	8 55 2	+0 25.88	0.00	...	...	10
317	... 3	8 55 2	+0 18.45	0.00	...	...	10
318	... 3	8 55 2	+0 14.00	0.00	...	...	10
	Comet d, 1882.						
	1882						
319	September 24	16 29 20	+0 6.88	0.00	...	...	14
320	... 24	16 31 13	+0 29.50	0.00	...	...	4
321	... 24	16 32 3	...	...	−0 59.3	0.0	6
322	October 11	15 33 26	...	...	−0 1.5	0.0	4
323	... 11	15 33 26	...	...	−0 54.4	−0.2	4
324	... 11	15 33 26	...	...	+4 26.1	+0.7	4
325	... 11	15 34 16	−0 22.46	0.00	...	...	8
326	... 11	15 34 16	−0 38.00	+0.01	...	...	8
327	... 11	15 34 16	−0 58.44	−0.04	...	...	8
328	... 12	15 43 39	−2 4.83	...	...	...	6
329	... 12	15 43 39	−2 35.72	+0.04	...	...	6
330	... 12	15 43 47	...	...	−4 21.4	−0.7	4
331	... 13	15 27 44	+2 51.38	+0.16	...	...	8
332	... 13	15 28 13	...	...	−9 15.1	−2.6	4

Number.	Apparent R. A.	Parallax.	Apparent Decl.	Parallax.	Observer.	Comparison Star.	Notes.
	h. m. s.	s.	° ′ ″	″			
311	5 51 43.43	+0.09	...	...	W	141	n_2 (?)
312	5 51 22.80	+0.08	...	...	W	142	Middle of nucleus.
313	...	...	−14 49 38.1	+2.3	W	142	" " "
314	...	...	...	...	W	143	" " "
315	...	...	...	...	W	143	" " "
316	...	...	...	...	W	144	" " "
317	...	...	...	...	W	145	" " "
318	...	...	...	...	W	146	" " "
			Comet d, 1882.				
319	7 40 19.46	+0.25	...	...	W	147	Comet very faint. Has a nucleus.
320	7 40 19.01	+0.25	...	...	W	148	
321	...	...	+ 6 43 23.5	+3.9	W	147	
322	...	...	−18 33 43.8	+6.8	W	149	Very faint in haze. Slight central condensation.
323	...	...	−18 33 45.4	+6.8	W	150	
324	...	...	−18 33 38.9	+6.8	W	151	
325	8 29 2.27	+0.40	...	...	W	149	
326	8 29 2.38	+0.40	...	...	W	150	
327	8 29 2.75	+0.40	...	...	W	151	
328	...	...	...	...	W	153	Strong central condensation.
329	8 32 54.89	+0.39	...	...	W	152	
330	...	...	−20 29 17.6	+7.1	W	152	
331	8 36 52.49	+0.43	...	...	W	154	In a group of faint stars.
332	...	...	−22 25 12.0	+7.1	W	154	

Number.	Mean R. A. 1880.0	Reduction.	Mean Decl. 1880.0	Reduction.	Authority.
	h. m. s.	s.	° ′ ″	″	
1	16 21 31.7	+1.95	+23 41.1	+ 4.0	DM 23° 2935.
2	16 32 31.01	+1.95	22 41 11.6	+ 4.0	Weisse 16h 976.
3	16 31 1.2	+1.95	22 43.9	+ 4.0	DM 22° 2992.
4	16 40 41.60	+1.96	21 50 48.5	+ 3.7	Weisse 16h 1246.
5	17 3 4.99	+1.99	19 20 31.0	+ 2.9	Weisse 17h 24.
6	17 12 19.0	+2.26	18 39.5	+ 7.0	DM 18° 3339.
7	17 47 40.5	+2.34	14 2.0	+ 9.1	DM 14° 3357.
8	18 20 49.55	+2.46	9 58 50.8	+10.7	Weisse 18h 452.
9	19 0 10.83	+2.43	12 1 32.8	+ 9.2	½ (Weisse 18h 1518 + Lamont 1246).
10	19 57 0.6	+2.26	19 23.8	+14.9	DM 19° 4254.
11	20 0 9.9	+2.27	19 23.9	+15.3	DM 19° 4278.
12	20 0 53.0	+2.27	19 23.1	+15.4	DM 19° 4286.
	1881.0		1881.0		
13	5 39 20.48	+1.71	46 40 33.5	— 2.7	O.Arg.N. 6201–2, Radcliffe 1554.
14	5 35 37.86	+1.72	46 48 48.5	— 2.7	O.Arg.N. 6142.
15	5 36 40.92	+1.77	49 46 19.6	— 2.9	"539 Sterne" 377.
16	5 38 58.52	+1.72	50 58 16.9	— 3.1	O.Arg.N. 6190–1.
17	5 53 5.81	+1.79	60 26 55.7	— 3.9	Krueger's Zones, (Astr. Nach. 2405.)
18	5 54 39.53	+1.79	60 27 12.2	— 3.9	Krueger's Zones, (Astr. Nach. 2408.)
19	5 54 43.86	+1.78	60 40 31.0	— 3.9	Krueger's Zones, (Astr. Nach. 2408.)
20	5 53 9	+1.79	61 6.3	— 3.9	Anonymous.
21	6 23 21.32	+1.66	70 35 35.8	— 5.1	O.Arg.N. 6920, Radcliffe 1745.
22	6 29 3.09	+1.60	72 27 23.8	— 5.2	O.Arg.N. 7023.
23	6 38 46.15	+1.50	74 16 3.2	— 5.5	O.Arg.N. 7167.
24	6 48 13.76	+1.41	75 24 1.5	— 5.6	O.Arg.N. 7336.
25	6 48 14.41	+1.39	75 34 24.6	— 5.6	O.Arg.N. 7334.
26	7 7 6	...	76 41±	...	Anonymous.
27	7 7 2	+1.19	76 41.6	— 5.6	DM 76° 272.
28	7 32 30	+0.81	78 43.3	— 5.8	DM 78° 264.
29	7 49 52	...	79 31.5	...	Anonymous. Est. 9.0 m.

Number.	Mean R. A. 1881.0	Reduction.	Mean Decl. 1881.0	Reduction.	Authority.
	h. m. s.	s.	° ′ ″	″	
30	7 49 49	...	+79 28.0	...	Anonymous. Est. 9.0 m.
31	7 50 45	...	79 33.3	...	Anonymous. Est. 9.5 m.
32	7 54 31.93	+0.49	79 33 43.0	− 6.2	O.Arg.N. 8462–3.
33	8 9 15	...	80 5.9	...	Anonymous. Est. 10.5 m.
34	8 14 0	...	80 4.9	...	Anonymous. Est. 9.0 m.
35	9 1 52	...	81 34.4	...	Anonymous.
36	9 20 0.22	−1.10	81 51 0.8	− 4.8	"539 Sterne" 137.
37	10 2 18.48	−1.83	82 17 59.4	− 3.8	Anonymous (Astr. Nach. 2424).
38	10 50 56.47	−2.44	82 19 2.9	− 2.6	Carrington 1628.
39	13 6 51	...	80 14.3	...	Anonymous. Est. 9.0 m.
40	13 10 57.31	−2.86	80 16 56.6	+ 1.9	Fedorenko, Supplement 160.
41	13 15 25	−2.87	79 56.7	+ 1.9	DM 80° 407.
42	13 19 16	−2.93	80 3.8	+ 2.1	DM 80° 409.
43	13 26 57.24	−2.85	79 35 50.1	+ 2.3	DM 79° 424 (Astr. Nach. 2424, 2437).
44	13 26 43.55	−2.71	79 19 13.2	+ 2.3	DM 79° 423 (Astr. Nach. 2409). Micrometrical comparison with Rad. 3039.
45	13 49 16.72	−2.75	78 47 51.7	+ 3.3	DM 78° 468 (Astr. Nach. 2424).
46	13 49 37	...	78 52.3	...	Anonymous. Est. 9.5 m.
47	13 55 18.38	−2.83	78 58 51.2	+ 3.7	O.Arg.N. 14191.
48	13 55 18	...	78 59.0	...	Anonymous. Est. 9.5 m.
49	13 42 9.93	−2.82	78 39 36.1	+ 2.6	O.Arg.N. 14003, Rad. 3099, Bonn 466, Gr. Nine Yr. Catalogue 1263.
50	13 53 30	−2.79	78 29.9	+ 3.3	DM 78° 470.
51	13 56 42	−2.79	78 34.0	+ 3.6	DM 78° 472.
52	14 9 19.99	−2.87	78 6 24.2	+ 4.0	"539 Sterne" 459.
53	14 32 1.51	−2.94	77 5 15.9	+ 4.8	Radcliffe 3237, Groombridge 2140.
54	14 42 17	...	77 7.4	...	DM 77° 551.
55	14 45 4	...	76 42.8	...	Anonymous. Est. 9.5 m.
56	14 45 32	...	76 42.8	...	Anonymous. Est. 9.5 m.
57	14 48 29.48	−2.92	76 50 38.4	+ 6.0	DM 76° 537 (Astr. Nach. 2424).
58	14 49 0	...	76 46.7	...	Anonymous. Est. 8.5 m.
59	15 33 9	...	75 18.5	...	Anonymous. Est. 9.0 m.

Number.	Mean R. A. 1881.0	Reduction.	Mean Decl. 1881.0	Reduction.	Authority.
	h. m. s.	s.	° ′ ″	″	
60	15 57 2	−3.05	+74 36.6	+10.3	DM 74° 639.
61	15 57 24	−3.04	74 35.1	+10.3	DM 74° 641.
62	16 30 4.92	−3.03	73 39 45.4	+12.9	Bonn 73° 723.
63	18 5 48.03	−1.85	71 6 58.5	+22.1	O.Arg.N. 17949–50.
64	5 50 57.47	+2.20	40 1 10.8	− 4.8	Astr. Nach. 599.
65	5 51 3	...	39 57±	...	Anonymous.
66	5 49 12	+2.20	39 56.9	− 4.7	DM 39° 1461.
67	5 51 50	+2.21	40 21.4	− 4.9	DM 40° 1473.
68	5 57 32.82	+2.24	40 41 37.5	− 5.2	Astr. Nach. 599.
69	5 58 58.48	+2.33	41 51 52.1	− 5.7	Weisse 5h 1868.
70	6 6 41	...	42 55.9	...	Anonymous.
71	6 5 54.60	+2.37	42 49 53.7	− 6.2	Weisse 6h 65.
72	6 7 20	...	42 56±	...	Anonymous. Faint.
73	6 8 9.82	+2.35	42 44 2.3	− 6.3	Weisse 6h 145.
74	6 9 26.17	+2.35	42 44 33.0	− 6.3	Bonn 42° 1522.
75	6 7 30	+2.39	43 9.0	− 6.3	DM 43° 1496.
76	6 1 4.96	+2.43	43 9 24.1	− 6.2	Weisse 5h 1948.
77	6 2 55.13	+2.42	43 11 3.6	− 6.3	Weisse 5h 2025.
78	6 8 13	+2.40	43 10.4	− 6.8	DM 43° 1502.
79	6 16 10.08	+2.39	43 36 31.1	− 6.9	Weisse 6h 383.
80	6 13 51.54	+2.40	43 34 30.6	− 6.9	DM 43° 1518 (Astr. Nach. 2437).
81	6 13 22.03	+2.43	44 6 39.0	− 7.0	Weisse 6h 295.
82	6 33 52	+2.53	46 52.8	− 8.6	DM 46° 1175.
83	6 34 48	...	46 52.1	...	Anonymous.
84	6 34 15	...	46 53.2	...	Anonymous.
85	6 34 5	+2.52	46 49.2	− 8.6	DM 46° 1176.
86	6 36 43.14	+2.51	46 48 54.6	− 8.6	O.Arg.N. 7184.
87	6 37 30	+2.50	46 39.8	− 8.6	DM 46° 1184.
88	6 58 32	+2.52	49 12.1	−10.1	DM 49° 1592.
89	6 59 52	+2.51	49 3.3	−10.1	DM 49° 1596.

Number.	Mean R. A. 1881.0	Reduction.	Mean Decl. 1881.0	Reduction.	Authority.
	h. m. s.	s.	° ′ ″	″	
90	7 42 21.45	+2.40	+51 55 53.8	—12.1	O.Arg.N. 8326.
91	8 44 26.96	+2.06	52 50 3.8	—13.1	O.Arg.N. 9363.
92	8 49 42.30	+2.02	52 45 21.5	—13.0	O.Arg.N. 9443.
93	9 24 53.51	+1.75	52 13 7.1	—13.2	"539 Sterne" 140.
94	13 34 37.65	+2.09	7 9 1.3	— 9.6	Lamont 1278, Rümker 4407.
95	6 12 47.61	+4.39	42 23 28.7	— 9.9	Radcliffe 1705, Groombridge 1140.
96	6 44 6.41	+4.58	42 45 31.6	—12.8	Weisse 6h 1280.
	1882.0		1882.0		
97	18 2 59.76	+1.23	36 18 58.2	—13.9	DM 36° 3020. Micrometrical comparison with Weisse 18h 44 and 18h 76.
98	18 3 57.26	+1.22	36 23 30.3	—13.9	Weisse 18h 76.
99	18 9 8.69	+1.29	38 44 27.8	—13.9	Radcliffe 3867.
100	18 10 49	...	38 46.5	...	Anonymous. Est. 9.5 m.
101	18 45 52.0	...	49 57.3	...	DM 49° 2874.
102	18 49 35.26	+1.40	51 54 53.2	—12.7	O.Arg.N. 18732.
103	18 51 57.3	...	51 54.4	...	DM 51° 2458.
104	19 4 1.6	...	54 39.3	...	DM 54° 2086.
105	19 5 51.5	...	54 39.0	...	DM 54° 2088.
106	19 19 16.03	+1.34	57 32 21.4	—11.7	O.Arg.N. 19209.
107	19 30 2.91	+1.34	60 36 53.3	—11.2	O.Arg.N. 19384.
108	19 32 5	...	60 42.1	...	Anonymous. Est. 9.5 m.
109	19 38 12.15	+1.30	61 44 12.5	—11.0	Bonn 61° 1888.
110	19 58 26	...	64 53.7	...	DM 64° 1402.
111	20 17 22	...	66 52.7	...	DM 66° 1283.
112	22 45 9.05	+0.33	72 2 34.9	— 5.8	O.Arg.N. 24761, Bonn 73° 996.
113	22 42 37.30	...	73 55 57.2	...	O.Arg.N. 24693.
114	1 29 6.55	+0.38	72 26 16.1	— 2.1	"539 Sterne" 347.
115	1 53 22.93	+0.45	71 50 57.3	— 1.6	"539 Sterne" 31.
116	2 22 48.08	+0.87	69 41 22.7	— 1.4	Bonn 69° 158.
117	2 27 16	...	69 34.2	...	DM 69° 166.
118	3 14 26.58	+1.50	64 9 44.7	— 1.2	Radcliffe 934.

Number.	Mean R. A. 1882.0	Reduction.	Mean Decl. 1882.0	Reduction.	Authority.
	h. m. s.	s.	° ′ ″	″	
119	10 33 53.89	+2.07	— 9 4 41.5	—11.4	Weisse 10h 581.
120	10 33 41.57	+2.09	9 24 10.5	—11.4	Weisse 10h 575.
121	10 30 25.23	+2.11	9 57 42.3	—11.2	Weisse 10h 515.
122	10 18 11.57	+2.27	12 43 28.9	—10.6	Weisse 10h 280.
123	10 17 32.38	+2.27	12 46 48.7	—10.5	Weisse 10h 274.
124	10 10 52	+2.41	15 7	—10.0	Anonymous.
125	10 10 34.57	+2.44	15 33 17.7	—10.0	Lalande 19967–68.
126	9 58 42.95	+2.70	18 52 9.9	— 9.4	O.Arg.S. 10333.
127	9 58 50.52	+2.70	18 50 23.2	— 9.4	O.Arg.S. 10335.
128	9 52 15.56	+2.81	20 37 7.7	— 9.1	O.Arg.S. 10252.
129	9 52 58	+2.81	20 25′	— 9.1	Anonymous.
130	9 51 2.34	+2.85	20 41 42.2	— 9.2	Lalande 19499.
131	9 43 8.11	+2.98	22 7 51.0	— 8.9	Lalande 19269.
132	9 42 57	...	22 8±	...	Anonymous.
133	9 14 56.53	+3.46	26 21 15.3	— 8.7	Washington Zones.
134	9 14 54	+3.46	26 21±	— 8.7	Anonymous.
135	8 52 57.73	+3.80	28 24 53.4	— 9.4	O.Arg.S. 9191.
136	8 54 15.06	+3.80	28 20 54.5	— 9.4	O.Arg.S. 9215.
137	8 18 44.27	+4.22	30 25 19.7	—10.2	O.Arg.S. 8484.
	1883.0		1883.0		
138	6 9 39.12	+2.06	22 11 6.6	—16.2	O.Arg.S. 4842–3.
139	6 10 45.48	+2.07	22 9 15.2	—16.2	O.Arg.S. 4871–2.
140	6 1 50.22	+1.93	19 55 27.3	—17.1	Lalande 11677.
141	5 50 29.69	+1.58	15 12 17.0	—17.8	Weisse 5h 1257.
142	5 54 23.74	+1.57	14 43 0.5	—18.0	⅓ (Weisse 5h 1362 + O.Arg S. 4507 + Lalande 11404).
143	5 51 7	...	14 36	...	Anonymous.
144	5 50 47	...	14 36±	...	Anonymous.
145	5 50 55	...	14 36±	...	Anonymous.
146	5 50 59	...	—14 36±	...	Anonymous.

Number.	Mean R. A. 1882.0	Reduction.	Mean Decl. 1882.0	Reduction.	Authority.
	h. m. s.	s.	° ′ ″	″	
147	7 40 9.84	+2.74	+ 6 44 29.8	— 7.0	Anonymous. (Astr. Nach. 2499).
148	7 39 46.77	+2.74	+ 6 39 8.3	— 7.0	Weisse 7^h 1029.
149	8 29 22.22	+2.51	—18 33 38.6	— 3.7	½ (Lalande 16914 + O.Arg.S. 8716).
150	8 29 37.86	+2.51	18 32 47.1	— 3.7	O.Arg.S. 8728.
151	8 29 58.73	+2.50	18 38 2.0	— 3.7	Lalande 16938.
152	8 35 28.10	+2.47	20 24 51.9	— 3.7	O.Arg.S. 8851.
153	8 34 57	+2.47	20 25±	— 3.7	Anonymous.
154	8 33 58.48	+2.47	—22 15 51.2	— 3.1	O.Arg.S. 8819.

PHYSICAL OBSERVATIONS

OF

COMETS,

1881-2.

Notes on the Tail of Comet b, 1881.

June 23.7. Egbert. Sketch showing outline of tail.

"Only stars *a* [Aurigæ] and *β* [Aurigæ] could be seen, so that the tail may not be properly proportioned. A line passed through the nucleus and the main part of the tail would intersect Polaris. Opera-glass used."

June 23, 15h 30m. Egbert. Sketch showing outline of tail with six stars: *a*, *β*, *δ*, *ξ*, and 17 Aurigæ, and 56 Camelopardalis.

"The stars put down were used in determining the position of the comet. The head nearly equal in brilliancy to Capella. Opera-glass used. A line passed through the comet would fall a little below Polaris." [This sketch is represented on Plate I. Measures of the sketch give for points in the axis of the tail:

$x = \frac{2}{9}$ of the distance from *ξ* Aurigæ to 56 Camelopardalis
$x' = \frac{2}{7}$ " " " *δ* Aurigæ to 17 Aurigæ.]

June 24, 9h 33m. Stone. Sketch showing outline of comet, with three stars: 2 Lyncis, 83 and 60 Camelopardalis. Plate I.

"(Entered from memory at 10 o'clock.) Tangent at *a* pointed to a point half-way between *a* and *γ* Ursae Majoris., *b* half-way between Camelopardalis 10 [60] and 31 [83]. *c* very nearly at Camelopardalis 10. *d*, = Camelopardalis 43, near the line of greatest brightness, was twice as far from nucleus as *b* or *c*. General direction of tail directly toward Polaris." [*a*, *b* and *c* were points in the edges of the tail. *d* was at the end of the axis. The identification of *d* as given in the note is undoubtedly wrong. It is probably Camelopardalis 81. A measure of the sketch gives for the axis

$x = \frac{3}{10}$ distance from Camelopardalis 83 to 60.]

June 26. Stone.

"At 15h M. T. there was a secondary tail much fainter than the first, but nearly or quite twice as long, extending in a great circle toward a point a little to the right of Polaris." [A sketch accompanies this note but no reference stars are given. As shown in the sketch, the principal tail was broad and curved the same as on the 24th. The long straight tail separated from the curved tail at about half the length of the latter from the nucleus.]

July 2, 12h 35m. Wilson. Sketch, Plate II, No. 1.

[No notes. The stars plotted are

1. 97 Camelopardalis
2. 93 "
3. 110 "
4. 103 "
5. 2 Draconis
6. 124 Camelopardalis
7. 123 Camelopardalis
8. 159 Cephei
9. Polaris
10. 131 Camelopardalis
11. δ Ursæ Minoris

There seem to be three distinct parts to the tail.]

July 3, 15h 0m. Stone. Sketch, Plate II, No. 2.

"Examined with naked eye. *a* [Camelopardalis 103] about half way to the pole." [The stars plotted are 1, 3 and 4 of the preceding note. This sketch was probably made in the dome at the beginning of the observations for position of the nucleus. For the axis

$x = 15'$ east of 97 Camelopardalis
$x' = 30'$ " 103 " .]

July 4, 12h. Stone. Sketch, Plate II, No. 3.

"A line drawn from *b* [δ Ursæ Minoris] will be tangent at *a* [right edge of tail on a line joining stars 2 and 3]. The tail is nearly included between two lines drawn from *d* and *b* [ε and δ Ursæ Minoris]." [The stars plotted were 1, 2, 3, 4, 5, 9 and 11 as given above. For the axis

$x = \frac{1}{2}$ distance from δ to ε Ursæ Minoris
$x' = \frac{1}{2}$ " 93 to 110 Camelopardalis.]

July 5, 13h 30m. Stone. Sketch, Plate II, No. 4.

"At *a* [near the nucleus] the tail points toward *c* [δ Ursæ Minoris], and at *b* [near the end of tail] toward *d* [ε Ursæ Minoris]." [The stars plotted were 1, 2, 3 and 4. The original sketch does not show the left edge quite so near star 3 as the engraving. For the axis

$x = \frac{1}{3}$ distance to ε Ursæ Minoris.
$x' = \frac{1}{2}$ " from 103 to 110 Camelopardalis.]

July 6, 13h 40m. Stone. Sketch, Plate II, No. 5.

[No notes. The stars plotted were 1, 2, 3, 4, 5, 6, 7, 9, 10 and 11. The left edge is perhaps a little too bright in the engraving. For the axis

$x = \frac{1}{2}$ distance from 103 to 123 Camelopardalis.]

July 13, 11h 0m. Stone. Sketch, Plate II, No. 6.

"In opera-glass. Fainter than hitherto, perhaps on account of clouds." [The stars plotted were probably 5, 9 and 10. For the axis

$x = \frac{2}{9}$ distance from 131 Camelopardalis to Polaris.]

July 15, 10h 20m. Wilson.

"Comet appears brighter to-night than for several nights past. Atmosphere very clear and transparent. Quite a large portion of the tail is visible with power 90. In the finder the tail can be followed to twice the diameter of its field [about 5°]. Appears quite bright. Nucleus dense."

July 15, 10h 0m. Stone. Sketch, Plate II, No. 7.

"As seen through opera-glass. At *a* [right edge of tail near the nucleus] the edge of the tail seemed parallel to a line joining *c* [2 Draconis] and *d* [123 Camelopardalis]. The brighter portion lay nearly in a straight line passing through a point midway between *e* and *f* [124 and 131 Camelopardalis]. All these stars are plainly visible to the naked eye. *c* may be 2 Draconis. Comet seems much brighter than usual, = 3½ magnitude." [The stars plotted were 5, 6, 7, 9 and 10. For the axis

x = 131 Camelopardalis.]

July 17, 14h 20m. Stone. Sketch, Plate II, No. 8.

"The tail seemed to be continually changing. At times it appeared almost in a straight line from the nucleus to *d* [131 Camelopardalis]; then to be concave toward *c* [123 Camelopardalis]; again to curve off toward *f* [left extremity in engraving], or lie in a straight line extending almost or quite to *e* [135 Camelopardalis]. The drawing gives something like the average appearance. The branches did not seem in motion, but rather to change continually in brightness. The head (4th mag.) is again quite bright this morning, but perhaps not quite as much so as on Friday night last, although the tail is fully as long and bright I think." [The stars plotted were 6, 7, 10 and 12 = 135 Camelopardalis. For the axis

x = 135 Camelopardalis.]

July 18, 14h 20m. Stone. Sketch, Plate II, No. 9.

"At times the tail extended almost in a great circle toward *b* [138 Camelopardalis], again the northern side was near *a* or *d* [135 or 131 Camelopardalis]." [The stars plotted were 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and 16.

13 = 138 Camelopardalis 15 = 129 Camelopardalis
14 = 126 " 16 = 127 "

For the axis,

x = 135 Camelopardalis.]

July 22, 14h 20m. Stone. Sketch, Plate II, No. 10.

"Extreme outlines extended from *b* to *c* [135 to 137 Camelopardalis]. Tangent at *a* [127 Camelopardalis] passes through *b*. Star *a* is a little outside. Scarcely perceptible beyond *de* [the middle of the tail as drawn]. Much fainter than hitherto. Different portions changeable. With opera-glass." [Stars plotted were 6, 7, 10, 12, 13, 14, 15, 16 and 17 = 137 Camelopardalis. For the axis

x = ⅓ distance 135 to 137 Camelopardalis.]

July 23, 9h 10m. Stone. Sketch, Plate II, No. 11.

"When the comet is examined at *e* [about ⅓ distance from nucleus to end of tail] it seems to point almost in a great circle to *a* [the right extremity]. If however it is examined near the end, it appears to point toward *b* [a point midway between stars 12 and 17]. Tail is scarcely perceptible beyond the line joining *c* and *d* [the stars 10 and 18]. The width of the field [opera-glass?] extends from Polaris to ε Ursæ Minoris." [Stars plotted were 10, 12, 17 and 18 = Carrington 1968. For the axis

$x = \frac{1}{2}$ distance from 135 to 137 Camelopardalis.]

July 23, 11h. Leavenworth.

"Left side brightest of the comet." [Accompanying this note is a sketch of the bright part of the tail as seen in the finder of the large equatorial. Both sides are nearly straight and the left is much brighter than the right. The finder inverts the object seen, so that it was really the right side which was brightest.]

DISCUSSION OF THE NOTES.

From these notes and sketches it is evident that Comet *b* had two distinct tails. The one was long, narrow and faint, and nearly straight in the direction opposite the sun. The other was the principal tail. It was bright, broad and curved. Perhaps also the faint portion on the left side of the tail on July 2 may be considered a part of a third tail, which deviates still more from the direction opposite the sun than the principal one. The straight tail was seen on June 26 and July 2, and perhaps also the straightness of the right side on July 3, 4 and and 22, was due to the presence of this branch, though so faint as to be invisible beyond the principal tail. The principal tail was brightest and largest on June 23 and 24 (the comet was then only $\frac{3}{10}$ of the distance from the earth to the sun), and decreased gradually with its increasing distance from both the earth and the sun. The irregular variations in brightness and form of the comet may be explained partly by the different conditions of the atmosphere and the phases of the moon at the times at which the observations were made. It is worthy of note however, that on July 6 the left side of the tail was longer and more distinct than the right (contrary to the usual appearance) and that on the same date a bright mass was observed to be thrown off from the nucleus into the left side of the tail. Whether these two phenomena were connected or not, it is of course impossible to state.

Unfortunately the notes in regard to the condition of the atmosphere are not sufficient to permit a study of its effect. The phases of the moon may be derived from the following table:

Date.	Time of Observation.	Moon Rises	
June 23	15h 30m	14h 56m	
24	9 33		New Moon.
		Sets.	
26	15 0	7 44	

Date.	Time of Observation.	Moon Sets.	
July 2	12h 35m	10h 35m	
3	15 0	11 2	
4	12 0	11 31	First Quarter.
5	13 30	12 4	
6	13 40	12 43	
		Rises.	Full Moon.
13	11 0	8 50	
15	10 0	9 54	
17	14 20	10 58	Last Quarter.
18	14 20	11 33	
22	14 20	14 34	
23	9 10	15 29	

From this table it will be seen that the observations from July 1'3 to 22 were affected by moonlight.

The positions of the reference stars used in the notes, as taken from Heis' catalogue and reduced to the epoch 1881.5 are as follows:

Number on Plate II.	Star.	α	δ
...	δ Aurigæ	87° 26′	54° 16′
...	ξ "	86 14	55 41
..	17 "	74 21	51 26
...	56 Camelopardalis	71 57	53 34
...	60 "	73 13	60 16
...	83 "	86 5	59 52
...	2 Lyncis	92 18	59 3
1	97 Camelopardalis	100 41	77 8
2	93 "	96 30	79 42
3	110 "	116 32	79 48
4	103 "	106 32	82 38
5	2 Draconis	140 2	81 51
6	124 Camelopardalis	154 9	83 10
7	123 "	153 7	84 51
8	159 Cephei	101 10	87 14
9	Polaris	19 7	88 41
10	131 Camelopardalis	192 3	84 4
11	δ Ursæ Minoris	272 40	86 37
...	ε " "	254 32	82 14
12	135 Camelopardalis	206 25	83 21
13	138 "	224 33	83 0
14	126 "	170 52	81 47
15	129 "	181 25	82 22
16	127 "	178 32	81 31
17	137 "	208 11	81 21
18	Carrington 1968	197 47	81 4

In the following reductions only the points in the axis of the principal tail (designated by x at the end of each note) are used, except for the observations of June 26 and July 2. The positions of the nucleus were computed with the aid of Dunér's elements (*Astronomische Nachrichten, No.* 2394):

$T = 1881$, June 16.442, Greenwich mean time.

$\pi - \Omega = 354^\circ\ 15'.2$
$\Omega = 270^\circ\ 57'.7$ } Mean equinox 1881.0.
$i = 63^\circ\ 25'.9$

$\log q = 9.865985$

$x = r\,[9.65082] \sin (356^\circ\ 25'.7 + v)$
$y = r\,[9.99185] \sin (243^\circ\ 25'.7 + v)$
$z = r\,[9.96124] \sin (328^\circ\ 28'.1 + v)$

Designating the coördinates of the nucleus by a and δ, those of the observed points in the tail by a' and δ', and those of the sun by a and d, and computing the position angle (p_0) of the radius vector, and the position angle and distance (p and s) of the observed points from the nucleus, we have:

Greenwich M.T.	a	δ	a	d	p_0
June 23.880	84° 4'.5	+46° 51'.5	93° 11'.8	+23° 25'.3	−20° 19'
24.632	84 48.0	50 0.9	93 49.6	23 24.2	−18 9
26.859	87 20.0	58 14.1	96 17.3	23 19.5	−14 15
July 2.758	98 5.0	72 34.8	102 23.3	22 58.0	− 5 12
3.859	101 2.2	74 20.3	103 31.8	22 52.2	− 2 56
4.734	103 32 8	75 32.9	104 25.8	22 47.4	− 1 1
5.797	106 56.2	76 50.5	105 31.4	22 41.1	+ 1 36
6.804	110 26.0	77 54.8	106 34.5	22 34.8	+ 4 20
13.710	140 54.5	81 53.2	113 36.1	21 40.8	+29 7
15.651	150 2.1	82 12.7	115 33.7	21 22.4	+36 33
17.831	159 28.6	82 18.2	117 45.4	21 0.2	+44 42
18.831	163 27.1	82 16.7	118 45.6	20 49.4	+47 7
22.831	176 51.4	81 52.7	122 45.2	20 2.8	+56 52
23.616	179 2.5	81 46.0	123 31.8	19 52.9	+58 19

and for the same moments:

	a'	δ'	p	s	$p - p_0$
June 23	83° 28'	+54° 20'	− 2° 46'	7° 28'	+17° 33'
24	82 14	59 59	− 7 22	10 2	10 47
26	18 57	88 0	− 3 35	31 5	10 40
July 2	272 40	86 37	+ 0 54	20 48	6 6
2	101 10	87 14	+ 0 27	14 39	5 39
2	192 3	84 4	+18 45	18 41	23 57
2	140 2	81 51	+25 39	12 28	30 51
2	100 41	77 8	+ 5 11	4 33	10 23
3	107 50	82 38	+ 5 58	8 24	8 54

	a'	δ'	p	s	$p-p_0$
3	100° 56′	+77° 8′	− 0° 27′	2° 48′	+2° 29′
4	267 31	84 26	+ 4 31	6 37	5 32
4	106 10	79 45	+ 6 19	4 16	7 20
5	111 32	81 13	+ 9 2	4 29	7 26
5	256 30	82 14	+ 7 42	6 52	6 6
6	125 37	84 11	+13 16	6 38	8 56
13	191 0	85 45	+31 17	6 18	2 10
15	192 3	84 4	+49 45	5 12	13 12
17	206 26	83 21	+57 7	5 47	12 25
18	206 26	83 21	+58 4	5 20	10. 57
22	207 1	82 41	+64 7	4 5	7 15
23	207 18	82 21	+67 44	3 54	9 25

On Plate *II*, p_0 is the direction toward the top; $p-p_0$ is the deviation of the tail from a line through the nucleus parallel to the side of the plate. The earth had just passed through the plane of the comet's orbit on June 21, $16^h\ 38^m$, so that the apparent deviation ($p-p_0$) of the tail from the radius vector was much less than its real deviation in the plane of the orbit.

For the reduction of the observations to the plane of the orbit, we compute the coördinates of the north pole of the comet's orbit:

$$A = 192°\ 6'.2$$
$$D = +23°\ 51'.0$$

and the following quantities:

	P	P'	S	v	log r	log ρ
June 23	60° 57′	220° 49′	95° 50′	+16° 14′.8	9.87473	9.4816
24	61 48	218 15	97 46	17 49.8	9.87652	9.4926
26	65 4	211 28	102 45	22 27.5	9.88275	9.5310
July 2	78 43	198 43	111 30	33 59.0	9.90468	9.6463
3	82 11	197 0	112 38	35 59.8	9.90948	9.6671
4	85 5	195 46	113 24	37 34.0	9.91343	9.6833
5	88 56	194 25	114 17	39 26.2	9.91838	9.7023
6	92 50	193 13	115 2	41 10.1	9.92319	9.7197
13	125 36	187 12	118 46	52 1.3	9.95856	9.8245
15	135 14	185 59	119 31	54 45.3	9.96894	9.8495
17	145 11	184 48	120 15	57 40.6	9.98075	9.8757
18	149 23	184 18	120 34	58 57.8	9.98618	9.8848
22	163 35	182 30	121 40	63 48.3	0.00793	9.9290
23	165 55	182 11	121 51	64 42.0	0.01217	9.9366

With the aid of these quantities we compute T (the angle at the nucleus between the earth and the observed point in the tail) and the coördinates ϕ and Δ of the observed points. To reduce the angles ϕ to the same epoch we apply the correction $d\phi$ and designate the corrected angle by ϕ'. The epoch June 27.434 is chosen in order to compare these results with those obtained by Professor Bredichin (*Annales de l' Observatoire de Moscou, Vol. VIII, Livr.* 1.).

	T	ϕ	$d\phi$	ϕ'	Δ
June 23	12° 59′	+21° 51′	—0° 37′	+21° 14′	0.1128
24	20 59	17 47	—0 28	17 19	0.1051
26	31 52	20 2	—0 8	19 54	0.1969
July 2	61 52	14 15	+1 38	15 53	0.1581
2	62 42	13 19	+1 12	14 31	0.1150
2	38 12	41 25	+0 46	42 11	0.1694
2	33 15	47 47	+0 31	48 18	0.1336
2	54 18	22 38	+0 38	23 16	0.0414
3	60 15	20 0	+1 6	21 6	0.0729
3	75 6	3 39	+0 43	4 22	0.0232
4	69 15	12 57	+2 5	15 2	0.0573
4	65 46	16 50	+0 58	17 48	0.0382
5	68 46	16 57	+1 10	18 7	0.0411
5	71 40	14 5	+2 30	16 35	0.0539
6	68 48	19 59	+1 34	21 33	0.0626
13	97 49	4 22	+3 40	8 2	0.0755
15	82 4	26 20	+2 54	29 14	0.0642
17	86 41	24 0	+3 44	27 44	0.0758
18	92 13	20 34	+4 4	24 38	0.0719
22	104 56	12 9	+4 34	16 43	0.0640
23	102 55	15 46	+4 27	20 8	0.0614

The points corresponding to ϕ' and Δ are represented on Plate *IX* by small circles. The scale of Δ is 1 = earth's mean distance from sun = 25 inches. The dotted lines represent the outline of the tail as observed on July 2.

Comparison with Theory.

Assuming $1-\mu=1$, we compute the coördinates of four points corresponding to the position, on June 27.434, of particles of matter emitted from the nucleus at the epochs May 27.775, June 4.781, 11.903 and 16.442. The true anomalies of the nucleus at these times were —40°, —25°, —10° and 0°. The resulting coördinates are

ϕ	Δ
42° 36′	0.2269
32 23	0.1336
22 20	0.0650
15 39	0.0327

These points are represented on Plate *IX* by crosses, on the curved line marked $1-\mu=1$.

It will be noticed that the curve drawn through these points passes almost exactly through the middle of the principal tail of July 2, and that the third point falls in the midst of the group of observed points. All of the observations in July, with the exception of July 13, which should probably be rejected, are fairly represented. Those in June indicate a greater repulsive force.

Assuming therefore $1-\mu=2.0$ and 2.6 for the principal tail, 12.0 for the straight branch and 0.3 for the faint curved branch, and taking as the epochs of emission of the different branches, respectively May 27.775, June 4.781 and June 16.442, we obtain the following results, using the accurate formulæ of hyperbolic motion:

$1-\mu$	M_1	log E	log P	F	ϕ	Δ
0.3	May 27.775	0.250016	0.321915	15° 44′ 10″	44° 53′	0.0669
2.0	June 4.781	0.467885	0.167015	44 46 22	33 22	0.2550
2.6	4.781	0.343862	9.962895	49 57 43	33 52	0.3232
12.0	16.442	0.072550	9.125613	58 42 12	16 54	0.3434

These points are also represented on Plate *IX* by crosses marked $1-\mu=0.3$, 2.0, 2.6 and 12.

The curve corresponding to $1-\mu=2.0$ passes between the observed points of June 23 and 24, and, as neither of these was determined with great accuracy, probably the mean of the two will be near the truth. The right branch observed July 2 corresponds to a value of $1-\mu$ greater than 2.6 but much less than 12.0. The axis $1-\mu=0.3$ is curved too much for the faint branch. Probably all three branches should be considered as belonging to Bredichin's Type *II*.

The observation of the straight tail on June 26 was not accurate enough to determine the value of the repulsive force, but from observations made elsewhere it was doubtless of Type *I*.

Notes on the Head of Comet b, 1881.

June 23, 16h. Stone. Sketch, Plate III, No. 1.

"Ray at 184°.9. Principal ray 170°.7. Radius opposite first ray of inner fan 55″.6. Radius parallel to first ray 103″.7." [The term "fan" designates the bright sector or fan-shaped emission of light on the sunward side of the nucleus. In the subsequent notes the term "jet" or "principal jet" is often used with the same significance. The "rays" observed were the sides of the fan.]

June 24, 8h 30m. Stone.

[Several outline sketches with measures, but no notes. Principal jet at 138°.5. From it arise three envelopes, the distance of their upper limits from the nucleus being respectively 35″.1, 69″.2 and 132″.0. Another jet at 264°.2. The nucleus is nearer the right than the left side of the head. There is a bright streak extending from the right branch of the principal jet dowh the right side of the tail. The position angle of a line through this is 344°.6.]

June 24, 15h. Stone. Sketch, Plate III, No. 2.

"The third jet was not seen at first and was much fainter than the others."

June 26, 15h 20m–16h 15m. Stone. Several outline sketches combined in Plate III, No. 3.

"Principal ray [left side of fan] 147°.0. Axis of tail 349°.3. Nucleus elongated in direction 203°.2. Height of principal ray 27.0, probably roughly in direction 113°.2. The height is equal to two-thirds of the distance to which it extends from the nucleus. Nucleus twice as long as broad. A third envelope was faintly visible. Was unable to obtain position on account of clouds. These sketches were made during clear intervals between clouds."

June 27, 9h 35m. Wilson. Sketch, Plate III, No. 4, *a*.

"Position angle of principal jet 99°.2. Height of principal jet, measured in direction 136°.7, 60″.2. Distance of outer envelope from nucleus, in direction 208°.3, 94″.5. General direction of envelope 181°.2."

June 27. Stone. Sketch, Plate III, No. 4, *b*.

9h 48m. "Nucleus elongated in direction 241°.6." [The sketch is on the preceding page to the note in the observing book, and therefore probably precedes it in time.]

June 27, 12h 0m. Wilson. Sketch, Plate III, No. 4 and No. 4, *c*.

"(Note written just after leaving the dome.) At first the middle jet appeared simply as a corner on the right jet, forming a right angle. Left jet was very faint, but longer than the middle one. The middle jet appeared to separate gradually from the right jet and to grow longer. Left jet grew somewhat brighter."

June 27, 13h 10m. Stone. Sketch, Plate III, No. 4, *d*.

"There are now three jets instead of one—the middle one brightest. The right hand one is the fainter of the three. The right hand jet is apparently in the same position as the single one was."

June 28, 12h. Stone. Sketch, Plate III, No. 5.

"The outer envelope extends about 5′ from the nucleus. The fan fades almost imperceptibly into the outer envelope."

July 1, 11h 50m. Wilson. Sketch, Plate III, No. 6.

"Position angle of right side of fan, .	102°.7	Length,	27″.4
" " left " " .	254.8	"	36.4
" " brightest part, .	170.2	Height,	35.4
Greatest length of fan, in P. A. .	293.3,		39.7
Extent of nebulosity, " . .	293.3		304.6
Diameter of nebulosity, " .	83.3		390.8"

July 2, 11h. Stone. Sketch, Plate III, No. 7.

"(Note written July 4.) The fan on Saturday night faded off, leaving no well-marked border. It was much fainter relatively than hitherto."

July 3, 14h 50m. Stone. Sketch, Plate III, No. 8.

"Estimated position angle [of middle of fan] 148°. 16h 30m.—Sketch similar to preceding one. Estimated position angle 40° [180°—40°= 140°?]. Right branch disappeared with dawn before left branch."

July 4, 12h. Stone.

"The fan, though perceptible, was much fainter than hitherto."

July 5, 11h 15m. Stone. Sketch, Plate III, No. 9.

"P. A. of right side of fan 88°.2. P. A. of left side 272°.4. Brightest direction 132°.8."

July 6. Wilson. Sketch, Plate III, No. 10, *a*.

"At first sight of comet, at about 10 P. M. (the early part of the evening had been cloudy) I was surprised to see a new jet, much brighter and narrower than the one usually visible, and opposite in direction. On closer examination this appeared to be separated from the nucleus by a distinct dark line. Thought at first that this might be due to the instrument being out of focus, but after focussing carefully on a bright star the appearance was the same, only the separation was more distinct. Concluded then that the nucleus had become double."

July 6. Stone. Sketches, Plate III, No. 10, *b* and *e*.

"After formation of separate nuclei final change took place during first measures.

10h	3m.	P. A. of Nuclei,	37°.5	...	...	Power I
"	"	" " New Jet,	...	54°.7	...	"
10	10	Distance of Nuclei,	...	...	5".60	Power II
10	19	" " "	...	...	6.27	"
10	23	P. A. " "	34.9	...	...	"
10	25	" " "	36.7	...	...	"

Jet is becoming less marked.

10	27	P. A. of Jet,	...	46.6	...	Power I
		" "	...	51.8	...	"
10	28	" "	...	54.8	...	"
10	19		36°.4	52°.0	5".94	

"The fan usually seen was not so well marked as usual. The jet, on the other hand, rivalled the nucleus itself in brightness, but was irregular."

July 6. Wilson. Sketch, Plate III, No. 10, *c*.

10h	35m	P. A. of Nuclei,	36°.8	...	...	Power I
10	48	Distance of Nuclei,	...	...	5".57	"
10	55	" "	...	...	6.15	"
11	2	" "	...	..	6.33	"
11	8	P. A. of Nuclei,	35.8	...	...	"

11	11	P. A. of Jet,	...	52.°0	...	Power I
11	14	" " "	...	54.0	...	"
11	16	" " Nuclei,	34.6	...	...	"
11	18	" " "	34.2	...	...	"
11	25	Distance	...	...	6.11	"
11	5		35.°4	53.°0	6.″04	

Sketch, Plate III, No. 10, *d*.

July 6. Stone.

12h	24m	P. A. of Nuclei,	38.°8	...	...	Power I
12	27	" "	37.8	...	...	"
12	37	Distance of Nuclei,	...	...	9.″68	"
12	47	" "	...	...	11.52	"
12	55	P. A. of Nuclei,	36.0	...	...	"
12	59	" "	37.1	...	...	"
13	1	P. A. of Jet,	...	41.4	...	"
13	4	" "	...	45.4	...	"
12	47		37.°4	43.°4	10.″60	

Sketch, Plate III, No. 10, *f*.

"The nucleus and envelopes at times seemed to flash up."

July 6. Wilson.

13h	24m	P. A. of Nuclei,	40.°5	...	...	Power I
13	27	" "	37.5	...	...	"
13	30	P. A. of New Jet,	...	43.°7	...	"
13	32	" "	...	44.7	...	"
13	38	Distance of Nuclei,	...	...	10.″35	"
13	46	" "	...	...	9.83	"
13	55	P. A. of Nuclei,	36.0	...	...	"
13	57	" "	36.2	...	...	"
13	59	P. A. of New Jet,	...	43.9	...	"
14	1	" "	...	42.8	...	"
13	43		37.°5	43.°8	10.′09	

[N. B.—Professor Stone measured the distance between the centers of the nuclei, while I measured the clear space between their edges. A correction of about 2″ should be added to my measures to make them consistent with his.—W.]

July 7. Wilson. Sketch, Plate III, No. 11, *a*.

"During visitors' hour (7 to 8 P. M.) the nucleus seemed much larger than last night and the fan denser. New jet had entirely disappeared."

July 7, 10h 35m. Stone. Sketch, Plate III, No. 11, *b*.

"P. A. of brightest portion of fan 155.°4. Seems to be continually changing."

July 8, 12h. Wilson. Sketch, Plate III, No. 12.

"Fan tonight is very wide. Nearly 180°."

July 9, 9h 40m. Stone. Sketch, Plate III, No. 13.

"P. A. of right side of fan 105°.5. Left side 255°.5. Brightest direction 176°.8. The nucleus was quite small and star-like. The fan was brightest in the direction 176°.8. The fan was first visible in the twilight, then it seemed centered in a mass of faint nebulosity which had a brighter portion shaped something like a fan."

July 12, 9h 25m. Stone. Sketch, Plate III, No. 14.

"P. A. of bottom of jet [left side] 249°.8. Comet much smaller and fainter. Only the fan visible when illumination was on. Did not examine with dark field."

July 15, 10h 25m. Wilson. Sketch, Plate III, No. 15.

"Comet appears brighter tonight than for several nights past. Atmosphere very clear and transparent. Quite a large portion of the tail visible with power 90. Nucleus dense."

July 18, 9h 10m. Wilson. Sketch, Plate III, No. 16.

July 23. Stone.

"There is no fan visible tonight. The nucleus is bright and well defined, and has about it a brighter surrounding nebulosity."

September 21, 9h 30m. Wilson. Sketch, Plate III, No. 17.

"Comet still has a tail; length equal semi-diameter of field, power 90 [9′]. Breadth, at widest part, ¼ diameter of field [4′.5]. Nucleus bright but small; quite well defined. Coma large, — ⅛ diameter of field [3′.6]."

September 24. Wilson.

"Comet bright in center. Tail visible ¼ diameter of the field [4′.5]."

October 20. Wilson. Sketch, Plate III, No. 18.

"Comet faint. Nucleus not well defined. Appears like an elongated mass of vapor."

October 25. Wilson.

"Comet faint. Nucleus scarcely distinguishable."

[Between July 23 and September 21 the comet was observed several times, but no notes or sketches were made. No attempt to observe it was made after October 25.]

DISCUSSION OF THE NOTES.

The principal features of the head of Comet *b*, 1881, as indicated by the above notes and sketches, were the "nucleus," the "fan," the "jets" and the "envelopes." During the first observations the comet was very near the earth, so that these features could be seen distinctly. As the distance increased the en-

velopes were the first to vanish, then the jets, then the fan and last the nucleus, leaving in October only an oblong hazy spot like a little cloud.

The Nucleus.

The notes in regard to the nucleus are very few, but the sketches made when it was nearest show it to have been very bright and dense, something like a planet in appearance. Its disc was elongated at times, so that the ratio of longest and shortest diameters was 3 to 2 and 2 to 1. The direction of this elongation seems to have varied. As measured on June 26 and 27, there was a change of nearly 40° in position angle. From the original sketches I have measured the position angle of the longest diameter on several dates when the sketches show a distinct elongation, although no mention is made of it in the notes. These measures are enclosed in brackets. Comparing these with the computed position angle (p_0) of the sun from the nucleus, we have

	p	p_0	$p - p_0$	Ratio of Diameters.
June 23.89	[190°]	158°.5	[+31°]	[3 : 2]
24.83	[245]	161.9	[+83]	[2 : 1]
26.83	203.2	165.7	+37.5	2 : 1
27.63	241.6	166.9	+74.7	2 : 1
28.73	...	...	[+80]	[2 : 1]
July 3.88	[215]	177.0	[+38]	[3 : 2]
5.70	[270]	181.1	[+89]	[2 : 1]
6.73	36.7	183.7	+33.0	Double
7.70	[260]	186.1	[+74]	[2 : 1]

On June 28 the nucleus made an angle of about 80° with the middle of the fan, but the direction of the latter was not measured. In the sketches of July 1 and 2 no elongation is noticeable. On July 6 the nucleus was double, the position of the components corresponding almost exactly with that of the elongation on June 23, June 26 and July 3.

An inspection of the column $p - p_0$ shows a remarkable oscillation between values ranging near 30° and 90°. The period of this oscillation seems to have been about 2.7 days, or some fraction thereof. The ratio of the diameters of the nucleus also seems to have varied, the elongation being at a maximum June 26 and June 27, minimum July 1 and maximum again July 6, when a division occurred and a portion was thrown off in the direction of the elongation, forming a secondary nucleus. After the division the nucleus proper became nearly round or perhaps a little elongated in the direction 90° from the sun. July 7 it was again decidedly elongated. The later sketches are indistinct as to the nucleus.

The Secondary Nucleus of July 6.

The measures of the secondary nucleus on July 6 show a motion in a straight line away from the nucleus proper. The position angle did not change sensibly in four hours, while in the same time the distance increased nearly 10″. Professor Stone's measures show an increase in distance between the centers of the nuclei of 4″.66 in two hours and twenty-eight minutes, a rate of 1″.89 per hour. My

measures of the clear space between the discs of the nuclei give an increase of 4″.05 in two hours and thirty-eight minutes, or 1″.54 per hour. Taking the mean of the two, we obtain 1″.77 as the hourly motion at twelve o'clock, equivalent to 400 miles, if perpendicular to the line of sight. Supposing this motion to have been uniform, the discs of the nuclei should have been tangent at about 8 P. M., local time. The actual separation probably took place later than that.

The following statement, written a few days later by Professor Stone, gives a fuller description of the phenomenon than the notes written at the time. This statement is essentially the same as that communicated to *Science, Vol. II, No.* 57:

"On that evening the comet was hidden by clouds until about 10 o'clock, local time, when Mr. Wilson went into the dome to observe its position with the eleven inch refractor. He soon, however, returned and called my attention to the remarkable appearance of the nucleus. I went to the dome and from that time until 3 o'clock we alternately examined the comet, making sketches and measures. The fan had its usual appearance, but when first observed there projected from the nucleus a bright red jet into the dark region on the side of the nucleus opposite the fan. This jet was totally different in appearance from those usually seen. It was at first straight, and in brightness rivalled the nucleus itself; in fact, at the first glance, it seemed to form one with the nucleus. On close inspection, however, I saw that it had a transparent appearance, but still intensely bright and red. The next glance showed that there was a thin, dark line separating it from the nucleus. Mr. Wilson had already called my attention to this dark line before I went to the dome. During the first few minutes a decided change took place. The jet seemed to separate and form a nucleus of its own, so that for a time the comet appeared double. Gradually the detached portion grew fainter until when last seen, at about 3 o'clock in the morning, although plainly visible, it was no brighter than the fan-shaped appendage on the opposite side of the nucleus.

"There can be no question that a great outburst took place in the comet on that evening, nor that a portion of the nucleus became detached and floated off into that portion of the tail immediately behind the fan. The phenomenon was watched very carefully for five hours, and I think I could hardly be mistaken in what I saw."

This statement contains about all that can be derived from the observations. If the oscillation of the nucleus as indicated above was real, the division on July 6 occurred near the minimum limit of the oscillation, so that we could detect no change in the position angle of the parts. The fact that the position angle of the jet is so much greater than that of the nuclei may indicate that it was emitted before the nucleus reached the limit of oscillation. The change in the observed position angle of the jet, although it was in the right direction for the oscillation, proves nothing, for during the last set of observations it had diminished to less than half its original length and was very faint.

The "Fan."

The "fan" or "principal jet" received the most attention. The term "jet" is probably the more proper one, for the outline of the "fan" was exactly the

profile of a jet, or a multitude of jets, thrown up from the sunward side of the nucleus and falling or rather driven backward, not to the nucleus but past it, toward the direction opposite the sun.

Comparing the sketches, it is evident that this "principal jet" was continually changing, both in form and direction, as well as in brightness. We notice the following phases:

Jet branched; upper limit well defined: June 24, 27, July 1, 3, 6, 7, 8, 12, 15, 18.

Jet not branched; upper limit round and well marked: June 23 and 26.

Jet not branched; no well defined limit: June 28, July 2, 4, 5 and 9.

The branches of the principal jet were in most cases unequal and unequally curved. This would be the natural result if the jet were emitted at an angle with the direction of the opposing force from the sun, and we shall find in fact, by examining the measures of the position angle, that the central or brightest direction of the fan was not exactly toward the sun. On the other hand we shall find also that the largest branch of the jet is sometimes on the same side and sometimes on the opposite side to the inclination of the central part.

The observation of June 27 gives evidence of the multiplicity of the jets composing the fan and of the velocity with which they were emitted, also that their emission was not constant nor simultaneous. At the beginning of the observation the whole emission was toward the right, at a large angle with the direction of the sun, then a jet was seen to rise gradually toward the sun inclined slightly to the left, reaching, within two hours and a half, the height of over 60″ (equivalent, at the distance of the comet at that time, to over 9,000 miles). Meanwhile another jet was thrown out to the extreme left with equal or greater velocity. At the end of the observation the middle jet was the brightest, and the one to the right had begun to diminish.

July 7 gives another illustration of the rapid variations in the principal jet. Between 7 and 8 P. M. the discharge was very abundant in both branches, and especially in the left. At $10^h\ 35^m$ the left branch had almost disappeared, and the brightest direction was toward the right and "seemed to be continually changing."

The lesser jets, apparently opposite the sun, seen June 23 and 24, may be explained as the result of the perspective. The comet was then between the earth and the sun, but out of the direct line and in such a position that a jet thrown exactly toward the sun would be directed away from the earth at an angle of about 145°, or only 35° from the line of sight. A jet emitted from the side of the nucleus opposite the earth and inclined more than 35° to the direction of the sun, would appear to be projected opposite to the sun.

The remarkable jet of July 6 can not be thus explained. The relative positions of the earth and the comet had so changed that the tail of the comet was then nearly perpendicular to the line of sight.

By September 21 the comet had receded so far that the angle between the earth and sun, as seen from the nucleus, was small. The jets were emitted toward the earth, obscuring both themselves and the nucleus.

The following table gives the width and brightest direction of the fan or

principal jet, and a comparison with the position angle of the sun. w is the angle between the sides of the fan, before recurving. The numbers in brackets were obtained by measuring the original sketches.

	w	p	p_0	$p-p_0$	Observer.	
June 23.89	[55°]	170°.7	158°.5	+12°.2	S	Moonlight.
24.83	[50]	138.5	161.9	—23.4	S	
26.83	[110]	147.0	165.7	—18.7	S	
27.63	[65]	...	...	...	S	
27.64	[50]	99.2	166.9	—67.7	W	
27.77	[110]	[150]	...	[—17]	W	
27.78	[130]	[170]	...	[+ 3]	S	
28.73	[110]	...	...	...	S	
July 1.72	[52]	170.2	173.0	— 2.8	W	
2.78	[30]	...	...	...	S	
3.87	[35]	155	177.0	—22	S	
3.90	[50]	140	...	—37	S	
5.70	184.2	132.8	181.1	—48.3	S	Moonlight.
6.73	[130]	[200]	183.7	[+16]	Wand S	Moonlight.
7.53	[140]	...	...	[+10]	W	Moonlight.
7.70	[130]	155.4	186.1	—30.7	S	Moonlight.
8.53	[180]	...	...	...	W	Moonlight.
8.73	[140]	...	...	...	W	Moonlight.
9.63	150.0	176.8	193.4	—16.6	S	Moonlight.
12.61	[100]	[200]	204.8	[— 5]	S	Moonlight.
15.66	[130]	...	...	...	W	Moonlight.
18.61	[130]	...	...	...	W	

The column w shows a variation between the limits 30° and 184°. This variation was irregular and appears to have been independent of the moonlight. In general the width of the fan was greater during the later observations.

The column $p-p_0$ exhibits a marked oscillation, but not so regular as that indicated by the nucleus. Excluding the numbers in brackets the signs, with one exception, are minus, indicating, perhaps, a tendency of the fan to fall behind the nucleus in its orbital motion.

If we suppose the center of the fan and the elongation of the nucleus to have been in the plane of the orbit, the evidence of oscillation becomes more marked in the measures of the fan but less marked in those of the nucleus, as will be shown by the following-table. ϕ is the angle $p-p_0$ reduced to the plane of the orbit.

	Nucleus ϕ	Fan ϕ
June 23	[+26°]	+ 17°.7
24	[+37]	—112.8
26	+38	— 73.2
27	+53	—116.8

	Nucleus	Fan
	ϕ	ϕ
June 27	...°	[— 61°]
July 1	...	— 6.0
3	[+55]	— 60.9
5	[+83]	— 74.9
6	+54	[+ 32.3]
7	[+82]	— 55.7
9	...	— 34.4

This supposition, however, makes the deviation of the fan from the direction of the sun too great in several instances. It is more probable that the brightest direction of the fan was not always in the plane of the orbit.

The Envelopes.

Of the separated envelopes seen June 23, 24 and 26 but little can be said, except that they resembled very much the envelopes of the great comet of 1858, which were found by Bond (*Annals of the Harvard College Observatory, Vol. III,*) to have been thrown off by the nucleus at regular intervals. Those observed June 24 were peculiar in that they retained the jet form. The appearance was that of three jets, the one within the other, emitted from the nucleus in the same direction and with different velocities, or with the same initial velocity and repelled by different forces from the sun. The height to which a jet would rise toward the sun may be expressed approximately by the formula $\varepsilon = \frac{g^2 r^2}{2(1-\mu)}$. If we know the initial velocity (g) we can easily compute by this formula the repulsive force ($1-\mu$), or vice versa. Professor Bredichin, from investigations of the tails of a great number of bright comets, has found that the initial velocity is usually about 0.03 in tails of Type *II.* The measured heights of the three jets June 24 were respectively 35″, 69″ and 132″, which in linear measure reduced to the plane of the orbit become 0.000086, 0.000169 and 0.000323. With these values of ε, assuming $g = 0.03$, we obtain $1-\mu = 3.0$, 1.5 and 0.8. These results agree very well with those obtained from the observations of the tail.

Notes on Comet c, 1881.

July 18. Stone.

"Strong indications of the formation of a tail. Nucleus not central."

July 19. Wilson. [Two sketches show a large nucleus and two bright wings.]

"Slight trace of tail can be seen. Very broad."

July 22. Stone. [Sketch shows bright nucleus and two wings at an angle of nearly 180°.]

"Nucleus not central. Observed in dawn. Nucleus still quite plainly visible. The wings were only visible after careful study. Still, after dawn had obliterated all else, traces of them were to be seen."

July 27. Leavenworth.

"Comet almost round."

June 28. Egbert. [Sketch shows bright nucleus, round coma, and very faint tail.]

"There is considerable haze in the atmosphere. Tail very indistinct. Edge of coma ill defined. Considerable condensation."

August 1. Egbert. [Sketch shows bright nucleus, round coma, and two branches of the tail.]

"Nucleus quite bright. Comet = 4.5 magnitude."

Notes on Encke's Comet.

September 21. Wilson.

"Comet large, very faint, nearly round. A little more dense on the south preceding side. Nucleus not very well defined. Width of coma 224″. This includes only what is plainly visible. Around this there seems to be faint light which extends some distance but is too faint to be measured. Comet just visible in finder."

September 24. Wilson.

"Comet very faint but comparatively large. About 4′ in diameter. Nearly round. South preceding portion a little more dense than the rest."

Notes on Comet e, 1881.

September 21. Wilson.

"Found comet after sweeping for a short time. It disappeared behind clouds before measures could be taken. Very small but comparatively bright. Had somewhat the appearance of a bright star through thick haze."

September 23. Wilson.

"Comet found at second sweep of telescope. Small, round, bright. Dense in the center. About 1′ in diameter. Disappeared quickly in the haze near the horizon."

September 24. Wilson.

"Comet faint in haze. Otherwise appearance same as last night."

September 29. Wilson.

"Comet large. Still round. Much brighter, although in moonlight."

October 10. Wilson.

"Comet quite faint. Still large and round. Got into the haze before I could make any measures."

Notes on Comet a, 1882.

March 24, 13h 51m. Wilson. Sketch, Plate IV, No. 1.

"The comet is small and faint, but has a starlike nucleus. This is brighter than star *d* [a faint star following the nucleus, estimated magnitude eleventh] and fainter than *c* [*DM* 36° 3022, magnitude 9.5]. The tail is straight and almost exactly parallel to the line of apparent motion of the stars. Its length, as far as I could trace it, was almost equal to half the distance between *a* and *b* [*DM* 36° 3020 and 3027 (=6′)]."

March 28, 15h 54m. Wilson. Sketch, Plate IV, No. 2.

"The tail in the direction 288°.2 may be an illusion of the eye produced by two very faint stars. The tail in the direction 262°.9 is quite distinct and extends two-thirds of the diameter of the field [12′]. The nucleus is larger and brighter than when I saw it last. It is about twice as bright as the star *b* [not identified]. I think *b* is a 9.5 magnitude."

April 12, 12h 8m. Wilson. Sketch, Plate IV, No. 3.

"Comet much brighter than when I last saw it. Visible in finder now. P. A. of tail 256°.8. Length equal diameter of field, power 90 [= 18′.2]. The tail does not appear exactly straight to-night, but curves soon after leaving the nucleus and then appears straight again. The P. A. near the nucleus is 269°.3. Nucleus very much condensed, and planetary in appearance. I could not see the short branch which I thought I saw on March 28."

April 14, 13h 47m. Stone. Sketch, Plate IV, No. 4.

"The tail can be traced securely one diameter of the field [power 90, = 18′.2]. P. A. 256°.0. The P. A. was obtained by placing the nucleus at the edge of the field and noting the general direction. Width of tail 53″.6, at a distance from the apex equal to the width. 14h 11m.—Star *x* [*DM* 51° 2456] is on left edge of tail. The tail seems as though made up of a great number of parts, the central of which are more crowded and longer, making the tail brightest along the axis, but somewhat jagged at the edge at distances from the nucleus greater than one-half diam-

eter of field. The axis, I think, was a little to the right of the center. The coma faded away very rapidly from the nucleus; no well-defined limit; shaded off imperceptibly into surrounding sky. Tail grew slightly broader for about one-half diameter of field [9′] then narrowed to a point. When examined closely I thought the *actual* edges of the nebulosity seemed to separate to the end. [Sketch.] At times I thought I saw nebulosity extending about one-third diameter of field farther [24′]. At times also I thought I saw a bend similar to that seen by Wilson on the 12th. In the finder the tail was plainly visible, but unless carefully examined, comet might easily be mistaken for a star. It was midway in brightness between the stars *a* and *b* [*DM* 51° 2471 (8.9 m.) and 2456 (8.4 m.)]. Estimated 7.5 magnitude."

April 17, 15h 54m. Stone. Sketch, Plate IV, No. 5.

15h 16m.—"Position angle of tail taken with nucleus placed in center of field, power 90, 259°.1. Length of tail 1.2 diameters of field [22′]. Above position angle would be true for about one-fourth diameter of field [4′.5] from nucleus. In the finder the comet is between *a* and *b* [*DM* 54° 2088 (8.9 m.) and 2089 (7.8m.)] in brightness. Estimated 8.0 magnitude.

"The axis was much brighter than on either side. The nucleus was stellar even with power *A*. With *A* it looked like a 10 m. star. The nebulosity at the apex was very faint, and brightest near the nucleus but on the opposite side from the apex. The apex was perhaps 20″ from the nucleus. The bend is a little exaggerated perhaps. Should judge the direction from the nucleus to the middle differs about 10° from the direction near the end. Width of the main part of the tail, excluding the faint projection on the left side, 129″.4. The projection is scarcely perceptible more than one-half or two-thirds the distance from the nucleus as given in the drawing.

"The bend was suspected when the comet was first observed, but when I left I was in doubt, as the tail at that time seemed *perfectly straight*. There were some bright stars near the end of the tail which may have caused an illusion. In the finder the comet looks larger and more diffuse than hitherto and shows more of the outline as seen in the large telescope."

April 20. Wilson.

"Tail nearly two diameters of field to-night."

April 20. Stone. Sketch, Plate IV, No. 6.

"13h 6m.—Position angle of tail 256°.2. The nucleus was placed at the edge of the field, power 90, and general direction measured. 13h 26m.—Position angle 255°.2; nucleus placed at center of field and general direction noted as before. Length of tail, 1.8 diameter of field [33′].

"In the finder the nucleus is midway between *a* and *c* [*DM* 57° 1977 (8.7 m.) and 1981 (9.0 m.)] in brightness. Estimated 7.0 magnitude. With power *A* the nucleus was about 9.2 magnitude. Star *d* [anonymous, about 2′ north of *DM* 57° 1981,] estimated 9.0 magnitude. Last time observed, the nucleus with high power looked like a very small, sharply defined star upon a faint nebulous background.

To-night with power *A* the surrounding nebulosity is almost as bright as the nucleus and fades off imperceptibly from it, and the nucleus seems larger and not so sharply defined as before.

"Power *I:* Distance from nucleus to apex 24.″8. Greatest width at about one-quarter field [4.′5] from nucleus, 165.″9. The brightest portion has a nearly constant width of 84.″9, but slightly spreading, with a bright nebulous line down the axis. When nucleus was placed at the edge of the field the other side of the field seemed to cut off the end of a tail of nearly uniform width, gradually fading from nucleus. Beyond, the tail was very faint. No bend anywhere, unless very near the nucleus where the position of the brighter portion was perhaps continually shifting. The axis was perhaps a little to the right (*i. e.*, south) of the center and more sharply defined on that side, especially a short distance from the nucleus. In other words, I had a suspicion of a similar form to that seen on the last night observed; but, if so, it was not nearly so marked as before."

April 23, 13h 10m. Wilson.

"P. A. of tail 259.°5 roughly. It is getting cloudy, so that I can hardly distinguish the tail for more than half the field, power 90 [9′]."

April 24, 13h 56m. Stone. Sketch, Plate IV, No. 7.

"In the finder the comet is midway in brightness between *d* and *f* [*DM* 61° 1888 (8.7 m.) and 62° 1747 (7.5 m.)]. Estimated 7 magnitude. In general the comet continues to grow brighter, still I can trace the tail only for one diameter of the field [power 90]. P. A. with nucleus at edge of field, 260.°8; with nucleus at center, 260.°3. Greatest width of tail 148.″8. Nucleus about two-fifths distance from right to left side of tail. A slight bend (?) toward the left one-half way to end of tail. With power 90 nucleus = 7.5 magnitude; star *d* [*DM* 61° 1888 (8.7 m.)] estimated 8.0 m. The star, however, shines with a much intenser light, whereas the nucleus had a perceptible size. Nucleus was apparently a mere condensation of nebulosity and the light not at all stellar. The star *d* orange; nucleus intensely *white*. Not examined with higher powers. The brighter portion of the tail along the axis ends in a point. The faint outer edges end bluntly (?)."

April 27, 10h 58m. Wilson.

"Tail of comet very faint on account of the haze. Can not see it farther than to the comparison star [9′]. P. A. 260.°4. Nucleus quite bright."

April 29, 10h 39m. Wilson.

"Tail visible about half diameter of field, power 90 [9′]. P. A. 276.°3."

April 29. Stone. Sketch, Plate IV, No. 8.

"11h 55m.—P. A. of axis of tail, nucleus in center of field, power 90, 296.°1. P. A. of axis, with nucleus just beyond edge of field, 297.°1. 12h 7m.—Greatest width of tail, at one-third field from nucleus, 179.″4. 12h 14m.—Distance from apex to nucleus 15.″2. [Sketch.] Axis about four-elevenths distance from right to left edge of tail. Tail much brighter near nucleus and along the axis for about one diameter field. Beyond that the difference is not noticeable, except there is

a gradual fading away from the nucleus. In finder 7 m.; power *I* 8 m.; power *A* 9 m. Only looks stellar with *A* at times. Perhaps flying clouds may account for this. At times I had a suspicion that the tail had a projection on the left side, as in the drawing. I feel quite certain that the tail is concave on the right side. It is much brighter near the nucleus than hitherto, but I am unable to trace it more than two diameters with power *I*. Clouds prevented my getting a parallel."

May 15, 12h 10m. Wilson. Sketch, Plate V, No. 1.

"Comet much brighter. Tail visible half diameter of finder. Nucleus very dense; with brightly illuminated wires it appears like a planet of the seventh magnitude. P. A. of tail at a distance equal to the diameter of the field, power *I*, 329°.6. The bright part is club-shaped or conical, densest and widest around the nucleus, gradually fading and narrowing to a point near the edge of the tail at a distance equal to diameter of field. P. A. of bright axis 331°.8. Looked at the nucleus with powers *II*, *III* and *A*. *II* and *III* spread out the nucleus somewhat and made the coma appear brighter than with *I*. Power *A* diminished the brightness of the head. I thought I could see a jet with this power in direction 225° from axis of the tail, but was not sure of it." [In the finder the tail extended between and a little beyond stars *DM* 72°, 85 and 88.]

May 16, 10h 20m. Wilson. Sketch, Plate V, No. 2.

"The comet has much the same appearance as last night and is somewhat brighter when the clouds do not interfere. There is the same denser cone at the right side of the tail as last night. P. A. of wires tangent to sides of tail at a distance equal to diameter of field, power *I*, 328°.4. P. A. of bright part 335°.0.

"10h 29m.—Before beginning measures I traced the tail easily to 3 diameters of power 90 [55′], but it has now clouded so that I can not see it more than two. Examined the head with powers *III* and *A*. Neither of them show anything like a dark axis to the cone, but rather that the central portion is the brightest. With *A* a decidedly bright streak is visible for a short distance from the nucleus. The coma is brightest on the side toward the sun, as if a fan is almost visible." [In the finder the extremity of the tail is midway between the stars *DM* 72°, 111 and 112.]

May 18, 10h 29m. Wilson. Sketch, Plate V, No. 3.

"P. A. of wires tangent to sides of tail at widest part, 338°.5. P. A. of bright part 345°.2. As before, there is a dense tail ending in a point near the right edge at about one diameter of field, power *I*, from the nucleus. A fan is visible to-night with power *I*, but too faint to be measured. The width I should estimate at about 100°. With power *A* the estimated diameter of the nucleus is 3″." [In the finder the tail passes centrally over stars *DM* 70°, 189 and 182 to 183.]

May 22, 11h 20m. Wilson. Sketch, Plate V, No. 4.

"Comet is very much brighter than when last observed, although seen through thick haze. A bright fan is visible, although small. P. A. of its sides, 114° and 205°. P. A. of bright axis of tail, 353.2. P. A. of lines tangent to sides of tail in field of power *I*, 346°.5. The comparison star is about a fifth

magnitude [*DM* 64° 391 (6.0 m.), Radcliffe 934 (5.3 m.)]. Nucleus in power *I* is 1 m. fainter than comparison star; in power *II* 2 m. fainter than comparison star; in power *III* 7 m. In power *A* the nucleus is no longer stellar, but is spread out so that I can not estimate its magnitude. Diameter 18″.4."

May 23. Wilson.

"Saw the fan distinctly while preparing to observe. Clouded up."

May 29. Wilson.

"Looked at comet through thick haze and smoke near the horizon. No comparison star visible. Nucleus very bright; about a second magnitude. Is of a dull red color, due to the smoke I suppose. Seems to flash and vary its light all the time. This may be due to the poor definition. Scarcely any tail is visible. The moon is nearly full."

DISCUSSION OF THE NOTES.

The interesting features of Comet *a*, 1882, were the bright nucleus and the narrow, pointed tail which it had when discovered, although the comet was then at a distance of 1.64 (astronomical units) from the earth and 2.03 from the sun. The sketches show a gradual increase in the brightness and dimensions of the tail, corresponding with its approach to the earth and sun. In all the sketches the axis is the brightest part of the tail. In the later ones there seem to be two parts or two tails, the one within the other, but with different axes; the inner tail bright, "club-shaped" or "conical," broadest at the nucleus and tapering to a point; the outer faint, slightly spreading, with its right side three or four times longer than its left. The sketches for May 15, 16 and 18 are not given to their full length on Plate *V*. They should extend a little below the bottom of the plate.

In reducing the observations I have used Lamp's elements of the orbit of the comet (*Astronomische Nachrichten No.* 2428):

$$\left.\begin{aligned} \pi &= 53^\circ\ 54'\ 40'' \\ \Omega &= 204^\circ\ 54'\ 50'' \\ i &= 73^\circ\ 47'\ 29'' \end{aligned}\right\} \text{Mean equinox 1882.0,}$$

$T =$ 1882, June 10.5266 Greenwich mean time.

$\log q = 8.783674.$

According to these the earth passed through the plane of the comet's orbit April 14 at $12^h\ 8^m$, Greenwich mean time. The observation on that date was made about seven and a half hours later. As, however, the change in the relative positions of the earth and comet would scarcely be perceptible in that time, the appearance should not be appreciably different from that seen in the plane of the orbit. The observed position angle of the axis agrees exactly with the computed position angle of the radius vector for that time. This shows that the axes of the different conoids of the tail were in the plane of the orbit. As seen they were therefore superposed, making the tail "seem as though it were made up of a great number of parts." The conoids were of different diameters,

and the narrower ones were naturally the longer, so that the central parts were "more crowded and longer, making the tail brightest along the axis, but somewhat jagged at the edges." The distance of the comet was so great that the hollow space, within the narrow conoids, was not visible. The extension of the sides to the full length of the tail, as shown in the sketch, was only suspected, yet it may have been real, for the tail was then turned away from the earth at an angle of 145°, so that the extremity would necessarily be very faint.

The observed width, 53′.6, was the actual thickness of the tail near the nucleus, equivalent to about 30,000 miles. The greatest thickness was somewhat more than that.

The Nucleus.

The following table gives all the estimates of magnitude of the nucleus, contained in the notes:

	Direct Estimates.			Estimates by Comparison	
	Finder.	Power *I.*	Power *A.*	with *DM* stars.	Observer.
March 24	...	10 0	...	...	W
28	...	9.3	...	...	W
April 14	7.5	...	...	½ (8.9+8.4)= 8.6	S
17	8.0	...	10.0	½ (8.9+7.8)= 8.4	S
20	7.0	...	9.2	½ (8.7+9.0)= 8.8	S
24	7.0	7.5	...	½ (8.7+7.5)= 8.1	S
				7.5+0.7 = 8.2	S
29	7.0	8.0	9.0	...	S
May 15	...	7.0	...	...	W
18	...	...	3″	...	W
22	...	6.0	18″	5.6+1.0 = 6.6	W
29	...	2.0	...	...	W

The effect of increasing the magnifying power was to diminish the brightness of the nucleus, although during the last observations the apparent size was increased.

Assuming the estimate 10.0, March 24, to have been correct, I have computed the magnitude (m_0) for each of the above dates, using the formula for the light of a planetoid (*Oppolzer's Bahnbestimmung page* 91). Comparing these with the estimates (m) made with power *I* and with comparison stars, we find that the agreement is very close, excepting the last, which was a very rough estimate:

	r	ρ	m_0	m	$m-m_0$
March 24	2.03	1.64	10.0	10.0	0.0
28	1.87	1.55	9.8	9.3	−0.5
April 14	1.57	1.23	8.9	8.6	−0.3
17	1.51	1.18	8.7	8.4	−0.3
20	1.45	1.13	8.6	8.8	+0.2
24	1.37	1.07	8.3	8.2	−0.1
29	1.26	1.01	8.0	8.0	0.0

	r	ρ	m_0	m	$m-m_0$
May 15	0.91	0.90	7.1	7.0	—0.1
18	0.84	0.89	6.9	...	...
22	0.73	0.89	6.6	6.6	0.0
29	0.52	0.91	5.9	2.0	—3.9

The Tail.

The following are the measures of the axis. s is the length of the axis for which the observed position angle p is true. l is the total length of the tail.

Greenwich M. T.	p	s	l	p_0	$p-p_0$	
March 24.81	270°±	6′	6′	266°.6	+ 3°	
28.90	262.9	12	12	264.1	— 1.2	
April 12.74	256.8	18	18	256.6	+ 0.2	
14.81	256.0	18	24	256.0	0.0	
17.86	259.1	18	22	255.5	+ 3.6	
20.79	256.2	18	33	255.5	+ 0.7	
20.79	255.2	9	33	255.5	— 0.3	
23.78	259.5	9	9	256.3	+ 3.2	Cloudy.
24.80	260.8	18	18	256.8	+ 4.0	
24.80	260.3	9	18	256.8	+ 3.5	
27.69	260.4	9	9	259.0	+ 1.4	Moonlight.
29.68	276.3	9	9	261.6	+14.7	"
29.73	297.1	18	36	261.7	+35.4	"
29.73	296.1	9	36	261.7	+34.4	"
May 15.74	329.5	18	40	325.8	+ 3.7	
16.66	328.4	18	55	329.6	— 1.2	
18.67	338.5	18	71	336.8	+ 1.7	
22.71	346.2	18	25	346.3	— 0.1	Moonlight.

I am unable to account for the sudden increase in the position angle on April 29. There must have been an extraordinary shifting, either of the tail of the comet or of the position circle of the telescope. The latter, in itself, would seem the more probable, but I can find no other evidence of it. The zero of the circle, determined before the observation on that night, agrees exactly with those determined on the preceding and subsequent nights. Besides, the circle screws on the tube of the telescope with a right hand screw and, when set, is turned as far as it will go. It could, then, only shift by turning to the left, which would decrease the observed position angle, whereas the angles actually observed were too great.

Excepting April 29, the column $p-p_0$ shows that the deviation from the radius vector was small. The larger angles on April 17, 23 and 24 may have been really measures of the bright cone which was so distinctly seen after May 15.

The latter was considerably inclined to the radius vector, as shown by the following measures;

	p	p_0	$p-p_0$	s
May 15	331°.8	325°.8	+6°.0	18′
16	335.0	329.6	+5.4	18
18	345.2	336.8	+8.4	18
22	353.2	346.3	+6.9	18

If we reduce these position angles to the plane of the orbit we obtain

	P	P'	S	T	ϕ
May 15	70°.9	200°.7	123°.1	103°.7	+ 9°.8
16	74.4	202.2	124.2	103.8	+ 8.7
18	80.8	205.5	126.4	97.7	+13.3
22	87.9	213.2	131.0	95.3	+10.4

The average of these values of ϕ is +10°.5 for May 18. This value is much greater than that which would correspond to $1-\mu=1$, and we therefore conclude that the bright part of the tail must be classed under Type *III*, composed of metallic vapors. The presence of metallic vapors in the part of the tail near the nucleus is confirmed by the spectroscopic observations in May and June, when the spectrum of the comet contained two very bright lines coincident with the D or Sodium-lines of the solar spectrum (*Astronomische Nachrichten No.* 2437, *Copernicus, Vol. II, No.* 24, *etc.*).

The positions of the extremity of the tail, as determined by reference stars in the finder, give the following results:

	p	s	$p-p_0$	ϕ	Δ
May 15	328°.2	0° 30′	+ 2°.3	+ 3°.8	0.0083
16	341.7	0 42	+12.1	+20.6	0.0109
18	344.7	1 11	+ 7.9	+12.5	0.0186

These are so discordant as to be of very little value.

The measures of the apex and the width of the tail are so few that it is hardly worth the while to discuss them. e is the distance of the apex from the nucleus, w the width of the tail and s the distance from the nucleus at which the width was measured.

	e	w	s	
April 14	est. 13″	53″.6	0′.7	
17	est. 20	129.4	4.5	
20	24.8	165.9	4.5	
...	...	84.9	4.5	Bright portion.
24	...	148.8	4.5	
29	15.2	179.4	6.	

The notes on the coma show that no jets were visible before the middle of May. Previous to that time the coma is described as fading rapidly toward the apex, and on April 17 as brightest on the side opposite the sun. A fan-shaped

jet toward the sun was suspected May 15 and 16, and was certainly seen May 18, 22 and 23. The comet was then at its least distance from the earth, 0.90, and rapidly approaching the sun.

After May 29 it was lost in the rays of the sun. Several attempts were made to find the comet after perihelion, but without success.

Notes on the Tail of Comet c, 1882.

[The observations of Comet *c* were all made by myself.—W.]

September 18.

"At about 1^h P. M. I received a telephone message stating that something which looked like a comet had been seen near the sun, by several persons at Proctor and Gamble's office, Cincinnati. I immediately looked and without difficulty, by simply shading my eyes from the sun with my hand, detected the comet, about 5° west and 1° south of the sun. The tail was visible for about ½°, and directly opposite the sun. At that moment the sky was perfectly clear around the sun, but before I could get to the dome and turn the equatorial on the comet, the rapidly flying clouds came over and I could only get glimpses of the comet between clouds. In the finder I could see a very bright round nucleus with two bright curved appendages like wings [Sketch, Plate VIII, September 18, *a*]. None of the tail could be seen in the large telescope."

September 18, 17^h 36^m.

"Comet has been visible to naked eye about 10 minutes. Length about 1°." [A rude sketch shows the tail convex on the left (north) side and straight on the right, spreading rapidly from the nucleus so that its width at the extremity is nearly half the length.]

September 24, 17^h 10^m.

"Tail of comet first seen above horizon at about 16^h 30^m, while I was observing Barnard's Comet. Tail then seemed about 15° long. Tail now is at least 10° long and 2° broad at extremity. There is a dark rift in the tail beginning not far from the nucleus and extending the whole length, as indicated in the sketch. The rift is not entirely dark, but contains some of the nebulous matter. The rift at the end is one-fourth as wide as the tail. The tail is slightly curved toward the left, looking from the head." [The sketch shows the left side of the tail longer than the right, and the rift is on the right side of the axis. The sketch was not reproduced, for want of reference stars.]

September 30, 16^h 45^m. Sketch, Plate VII, No. 1.

"Tail visible at 16^h in full moonlight (moon on the meridian) through thick fog. Head not up yet. 16^h 40^m.—Right side of tail is directed toward the bright

star a Hydræ and extends five-eighths of the distance. There seems to be a narrow rift in the tail near the right side, extending about two-thirds of the length from the head. $16^h\ 55^m$.—The left edge seems to fade off gradually while the right is well defined. Clear. The light at the extremity of the tail seemed variable, extending at times 1° farther than at others."

October 4.

"Tail visible at $15^h\ 35^m$, through thick haze and fog. Moon at last quarter, 60° from comet. Position of end of tail, south side, $\alpha = 9^h\ 35^m$, $\delta = -10°\ 39'$; north side, $\alpha = 9^h\ 35^m$, $\delta = -7°\ 34'$. Middle of tail, $\alpha = 10^h\ 8^m$, $\delta = 8°\ 39'$. The dark rift near the right side of the tail was not so plainly visible as at other times, yet it was evident."

October 5.

"Tail half way up at $15^h\ 40^m$. At $17^h\ 50^m$ tail extended three-fourths the distance to a Hydræ. Central line pointed almost exactly toward a Hydræ. Slightly curved upward. Did not notice the dark rift."

October 6, $17^h\ 40^m$.

"Central axis of tail pointed almost exactly toward a Hydræ. Curved slightly upward. Right edge well defined; left fades off gradually. Extremity 4° wide." [A rough sketch shows that the outline of the tail was nearly the same as on September 30, the bright part nearly straight and spreading gradually from the head, the faint part on the left.]

October 10.

"Saw end of tail at 16^h through rift in clouds. It extended to a Hydræ at left or upper extremity. 4° broad at the end."

October 12, $16^h\ 30^m$. Sketch, Plate VII, No. 2.

[On the original sketch the following stars were plotted: 10 Sextans, a, λ, v^2, v^1 and μ Hydræ. λ and v^2 Hydræ were seen through the bright part of the tail.]

October 13, $16^h\ 0^m$. Sketch, Plate VII, No. 3.

"Tail has very much the same appearance as yesterday. Perhaps the extension of the right extremity is a little longer." [The stars plotted were: 10 Sextans, a, λ, v^1, 49 and 51 Hydræ. v^2 Hydræ should have been in the middle of the brightest part of the tail, but does not appear in the sketch.]

October 19, $16^h\ 0^m$. Sketch, Plate VII, No. 4.

"Comet is not nearly so bright to the eye as last time I observed it. The tail seems more nearly straight, a little broader and shorter. There is a bright star [v^1 Hydræ] in the brighter part of the tail about two-fifths of the length from the head." [The stars plotted were: a, λ, v^1, 49, 51 and 16 Hydræ.]

October 29, $15^h\ 15^m$.

"Tail visible in bright moonlight to about 5° beyond a Hydræ in R. A."

November 2, 16h 25m. Sketch. [Outline given on Plate VI.]

"The moon is nearly half full and just north of α Hydræ at a distance equal to the length of the comet. Yet the tail is plainly visible for the whole length sketched. There is no extension at the right extremity, as seen last time. The tail is very bright for half its length on the lower [right] side, fading off gradually toward the upper [left] side and extremity." [The stars plotted were: α, λ, v^1, v^2, μ, 49, 51, 16, 9, 10, 59, 69, 79, 80 and 84 Hydræ. Right extremity near 10 Hydræ, left midway between 16 and 49 Hydræ, middle extremity at 16 Hydræ.]

November 3.

"The general appearance of the tail is about the same as yesterday. A little brighter because of less moonlight."

November 7, 14h 40m to 15h 0m. Sketch, Plate VII, No. 5.

"Tail is very bright yet. No moonlight. Nothing peculiar about the tail. At 15h 12m a meteor passed exactly across the middle of the comet's tail at right angles. Third magnitude. Left a train of sparks brighter than the comet, so that the streak was visible for an instant on the tail." [The stars plotted were: 9, 10, 16, 59, 69, 79, 80 and 84 Hydræ, and several faint stars visible with an opera-glass. The star marked 10 on Plate *VII* is not correctly placed in this engraving. It should be near the axis of the tail.]

November 14, 17h 30m. Sketch, Plate VII, No. 6.

"Clear between clouds. Did not have time to observe position. Stars all visible to the naked eye. Between 17h 30m and 17h 35m I saw three bright meteors (all brighter than the first magnitude) fall from the direction of *The Sickle* [*Leo*] across the tail of the comet. Each left a train of sparks across the tail of the comet, visible for a second or more. One crossed near the head, another near the middle, the other near the end of the tail. [The stars plotted were: 9, 10, 16, 59, 69, 79 Hydræ and 64 and 66 Argo.]

November 20, 17h 25m. Sketch, Plate VII, No. 8.

"Stars all visible to naked eye." [The stars plotted were: 9, 10, 16, 59, 69, 79 Hydræ, 50, 60, 64, 66, 67 and 70 Argo.]

November 29.7.

"Moon at last quarter, just north of comet. Comet visible to naked eye. Has a faint tail about 5° long."

December 11.6.

"Comet not more than 4° long. Not very bright. Sky hazy."

January 29.4, 1883.

"Cleared off at 9 P. M. Saw comet for a few minutes. Scarcely visible to naked eye. With opera-glass tail is about 4° long. With large telescope, power 90, scarcely any tail at all is visible. Clouded up before I could obtain measures for position." [A rough sketch shows that the tail extended to ν Canis Majoris.]

January 31.

"Comet scarcely visible with opera-glasses."

DISCUSSION OF THE NOTES.

The above notes and sketches were, most of them, made very hurriedly, while I was preparing to observe the position of the nucleus, and while the head of the comet was very near the horizon, so that they are not accurate in detail. My object in making them was only to get the position of the extremity of the tail by reference to easily identified stars.

The sketches show two distinct parts of the tail; the one very bright, composed of a single narrow conoid, spreading gradually from the nucleus; the other much fainter, nearly twice as broad as the first and spreading a little more rapidly. Both parts were curved slightly toward the left (north). This curvature apparently increased until the middle of November, after which it gradually decreased. The axis of the fainter part was inclined several degrees to the left of that of the brighter part. On September 24 only the bright conoid could be seen. The hollow space, within the conoid, was visible as a dark channel or "rift" traversing the whole length of the conoid. This channel was not perfectly dark, but the light in it was faint in comparison with that on either side. The channel did not coincide with the axis of the bright part of the tail, but was wholly on the right side of the axis. September 30 both parts of the tail were visible and nearly equal in length. The dark channel was closed at both ends, and less marked. After October 5 the dark channel was not noticed. October 12, 13 and 19 the right side of the bright conoid was apparently much longer than the broad part of the tail. November 7, 14 and 20 the bright conoid could not be distinguished for more than two-thirds of the length of the tail, and instead of spreading seemed to taper to a point within the right edge of the tail.

I did not at any time see the faint projection of the tail toward the sun which was seen by several observers from the 5th to the 15th of October. The reason has been stated above, viz: that the head of the comet was always very near the horizon when I examined it with the naked eye.

In the reduction of the observations I have used the points represented by stars within or very near the limits of the tail, and in the brightest part. The positions of the stars on Plates *VI* and *VII* were taken from *Heis's Catalogue* and reduced to 1882.0. Those on Plate *VII* are as follows:

Number.	Name.	α	δ
1	α Hydræ	140° 28′	— 8° 9′
2	10 Sextans	146 40	— 7 33
3	λ Hydræ	151 13	—11 46
4	υ^2 "	149 51	—12 30
5	υ^1 "	146 27	—14 16
6	51 "	138 42	— 9 3
7	49 "	138 32	—11 29
8	16 "	130 13	—13 7
9	9 "	128 37	—12 4
10	10 "	129 4	—15 31

Number.	Name.	a	δ
11	59 Hydræ	140° 29′	−21° 50′
12	69 "	141 57	−20 36
13	79 "	143 59	−23 4
14	80 "	144 15	−23 23
15	50 Argo	126 34	−19 10
16	64 "	135 43	−23 23
17	66 "	139 15	−25 28

The right extremity is designated by *Re*, the left by *Le*, the middle by *Me*, and the middle of the brightest part by *M*. The stars observed for these points were:

		Le	*Me*	*Re*	*M*	
September	30	...	...	1	...	s = ⅝ distance.
October	4	...	...	...	...	
	5	...	1	...	...	
	6	...	1	...	...	
	10	1	...	...	...	
	12	1	...	7	½ (3 to 4)	
	13	1	...	7	4	
	19	6	7	¾ (7 to 8)	5	
November	2	½ (7 to 8)	8	¾ (8 to 10)	10*	*s = ⅓ distance.
	7	...	8	10	⅓ (12 to 11)	
	14	8	10	...	...	
	20	⅓ (10 to 15)	...	$\frac{1}{10}$ (15 to 10)	15*	*s = ⅓ distance.
January	29	...	ν Canis Majoris	...	...	

The elements of the orbit of the nucleus were:

T = September 17.2304, Greenwich mean time.

$\left.\begin{aligned} \pi &= 55^\circ\ 12'.7 \\ \Omega &= 345\ \ 50.6 \\ i &= 141\ \ 54.9 \end{aligned}\right\}$ Mean Equinox 1882.0.

$\log q = 7.88356.$

$x = r\,[9.99500] + \sin(170^\circ\ 35'.9 + v)$

$y = r\,[9.98762] + \sin(262\ \ 43.0 + v)$

$z = r\,[9.44651] + \sin(\ 48\ \ 59.5 + v)$

The coördinates of the nucleus and the sun, and position angle of the radius vector for the moments of observation were:

Greenwich M. T.	a	δ	a	d	p_0
September 30.935	160° 15′.9	− 6° 59′.6	187° 27′.8	− 3° 13′.5	263° 28′
October 4.951	158 30.5	− 8 54.1	191 7.0	− 4 46.9	264 56
5.950	158 7.0	− 9 21.5	192 1.7	− 5 10.0	265 19
6.971	157 43.8	− 9 48.9	192 57.7	− 5 33.5	265 42
10.901	156 19.7	−11 31.2	196 34.3	− 7 3.0	267 14

Greenwich M. T.		a	δ	a	d	p_0
	12.970	155° 37′.4	—12° 23′.2	198° 29′.2	— 7° 49.9	268° 4′
	13.922	155 18.2	—12 46.7	199 21.1	— 8 10.8	268 27
	19.933	153 17.7	—15 11.1	204 59.9	—10 23.3	271 6
November	2.981	148 8.8	—20 26.5	218 32.5	—15 7.6	278 13
	7.926	145 59.3	—22 9.2	223 27.9	—16 37.1	281 17
	14.964	142 29.5	—24 29.2	230 37.3	—18 32.3	286 58
	20.961	139 3.6	—26 16.2	236 51.3	—19 57.8	291 16
January	29.610	93 12.9	—22 43.8	312 21.5	—17 46.5	46 41

For the observed points in the tail we have at the same moments:

			a'	δ'	p	s	$p - p_0$
September	30	*Re*	140° 28′	— 8° 9′	265° 22′	12° 14′	+ 1° 54′
October	4	*Re*	143 45	—10 39	261 56	14 33	— 3 0
	4	*Le*	143 45	— 7 34	274 9	14 32	+ 9 13
	4	*M*	152 0	— 8 30	273 6	6 12	+ 8 10
	5	*Me*	140 28	— 8 9	272 32	17 33	+ 7 13
	6	*Me*	140 28	— 8 9	274 10	17 14	+ 8 28
	10	*Le*	140 28	— 8 9	280 43	15 57	+13 29
	10	*Re*	140 28	—12 9	266 2	15 33	— 1 12
	12	*Le*	140 28	— 8 9	284 25	15 21	+16 21
	12	*Re*	138 22	—11 29	271 13	17 1	+ 3 9
	12	*M*	150 32	—12 8	272 18	5 9	+ 4 17
	13	*Le*	141 0	— 8 23	285 21	14 37	+16 54
	13	*Re*	137 22	—11 29	272 19	17 32	+ 3 52
	13	*L*	151 13	—11 46	283 48	4 23	+15 21
	13	*M*	149 51	—12 30	272 30	5 4	+ 4 3
	19	*Le*	138 42	— 9 3	291 35	15 36	+20 29
	19	*Re*	132 18	—12 43	274 17	20 27	+ 3 11
	19	*Me*	138 32	—11 29	282 38	14 52	+11 32
	19	*M*	146 27	—14 16	276 59	6 44	+ 5 53
November	2	*Le*	134 22	—12 18	299 30	15 28	+21 17
	2	*Me*	130 13	—13 7	290 16	18 42	+12 3
	2	*Re*	129 22	—14 56	284 3	18 43	+ 5 50
	2	*M*	129 4	—15 31	282 4	6 15	+ 3 51
	7	*Me*	130 13	—13 7	298 24	17 35	+17 7
	7	*Re*	129 4	—15 31	289 35	17 20	+ 8 18
	7	*M*	141 28	—21 0	284 23	4 35	+ 3 6
	14	*Le*	130 13	—13 7	312 11	16 18	+21 46
	14	*Me*	129 4	—15 31	302 55	15 29	+15 57
	20	*Le*	128 14	—16 44	311 18	13 49	+20 2
	20	*Re*	126 49	—18 50	300 51	13 27	+ 9 35
	20	*M*	126 34	—19 10	299 4	4 31	+ 7 48
January	29	*Me*	97 53	—19 19	38 31	5 22	— 8 10

For the reductions to the plane of the orbit we compute the coördinates of the North Pole of the comet's orbit

$$A = 237^\circ\ 20'.6$$
$$D = -73\ 45.9$$

and the following quantities:

		P	P'	S	v	log r	log ρ
September	30	163° 55′.2	259° 30′.8	100° 18′.6	167° 16′.3	9.79422	0.11704
October	4	163 44.1	261 45.4	101 39.5	168 19.9	9.86948	0.13014
	5	163 41.6	262 16.0	101 59.1	168 32.8	9.88544	0.13287
	6	163 39.1	262 46.3	102 19.1	168 45.0	9.90096	0.13564
	10	163 29.8	264 37.4	103 33.8	169 25.1	9.95386	0.14498
	12	163 25.1	265 33.5	104 11.9	169 42.8	9.97848	0.14906
	13	163 23.0	265 59.0	104 29.1	169 50.3	9.98892	0.15075
	19	163 9.9	268 38.1	106 13.7	170 30.5	0.04834	0.15952
November	2	162 42.8	275 11.2	109 48.9	171 35.0	0.15236	0.17032
	7	162 35.8	277 46.6	110 51.0	171 51.7	0.18170	0.17219
	14	162 30.0	281 49.3	112 6.8	172 13.2	0.22056	0.17411
	20	162 31.4	285 36.1	112 52.9	172 27.2	0.24698	0.17599
January	29	170 26.6	326 47.5	99 19.5	174 5.4	0.45908	0.34329

The angles ϕ are reduced to the epoch October 19.933. In computing $d\phi$ I have assumed $1-\mu = 2.6$ for the right extremity, $1-\mu = 1.5$ for the middle extremity, $1-\mu = 1.0$ for the left extremity and the middle of the bright part of the tail.

Right Extremity.

		T	ϕ	$d\phi$	ϕ'	Δ
September	30	137° 29′	+ 5° 18′	−2° 9′	+ 3° 9′	0.5502
October	4	124 42	− 8 52	−1 19	−10 11	0.5193
	10	131 58	− 2 42	−0 45	− 3 27	0.6970
	12	140 23	+ 5 48	−0 40	+ 5 8	1.0983
	13	141 28	+ 6 48	−0 36	+ 6 12	1.1895
	19	141 3	+ 4 54	0 00	+ 4 54	1.5898
November	2	145 17	+ 6 17	+1 1	+ 7 18	1.7232
	7	147 40	+ 7 45	+1 15	+ 9 0	1.6452
	20	150 32	+ 6 46	+1 32	+ 8 18	1.2642

Left Extremity.

October	4	149 22	+17 5	−2 59	+14 6	1.2211
	10	152 11	+19 19	−1 43	+17 36	1.8659
	12	153 50	+20 59	−1 14	+19 45	1.9881
	13	154 0	+21 4	−0 59	+20 5	1.8091
	19	154 54	+21 24	0 00	+21 24	2.3525
November	2	153 42	+17 44	+1 38	+19 22	2.1002
	14	153 57	+15 18	+2 50	+18 8	2.5015
	20	153 44	+12 35	+2 40	+15 15	1.6612

Middle Extremity.

		T	ϕ	$d\phi$	ϕ'	Δ
October	5	146° 40′	+13° 57′	−1° 56′	+12° 1′	1.5054
	6	148 5	+15 18	−1 52	+13 26	1.5973
	19	149 15	+14 20	0 00	+14 20	1.3536
November	2	149 24	+11 36	+1 13	+12 49	2.3014
	7	152 1	+13 55	+1 46	+15 41	2.4877
	14	152 11	+12 8	+1 41	+13 49	1.8662
January	29	166 11	− 3 24	+4 13	+ 0 49	1.4031

Middle of Bright Part.

October	4	148 5	+14 41	−1 38	+13 3	0.3358
	12	141 59	+ 7 32	−0 30	+ 7 2	0.2337
	13	141 44	+ 7 5	−0 24	+ 6 41	0.2282
	19	144 11	+ 8 26	0 00	+ 8 26	0.3483
November	2	143 41	+ 4 19	+0 43	+ 5 2	0.3216
	7	144 8	+ 3 11	+0 45	+ 3 56	0.2288
	20	149 50	+ 5 38	+1 8	+ 6 46	0.2728

The points corresponding to ϕ' and Δ are represented on Plate *X;* those for the right extremity by ⌊,s; those for the left extremity by ⌋,s; those for the middle extremity by small circles, and those for the middle of the brightest part by dots. *BC* is the limit of the tail on October 19, *DE* on November 7. The scale of Δ is $1 = 2.5$ inches, exactly $\frac{1}{10}$ the scale used for Comet *b*, 1881, Plate *IX.*

The left side of the tail was much longer than the right, but in perspective appeared the shorter of the two after September 30. Both sides were very much foreshortened in perspective, as the tail was turned away from the earth at an angle of over 140°. The direction of the left extremity from the nucleus was over 150° from the earth. Had the tail been vertical to the line of sight on October 19 it would have spanned an arc of nearly 60°.

The Δ,s show a rapid increase in the length of the tail up to about the 7th of November, after which there is a decrease. If we draw curves through the Δ,s for each extremity, and extend them backward, we find that they become zero very soon after the time of perihelion passage, September 17. This would seem to indicate that the matter which formed the tail was thrown off from the nucleus after perihelion, and that it was the same matter which formed the extremity, at least of the brighter part, from September 24 to some time in November. The earlier observations of the faint part are less certain, for the earth was then very near the plane of the comet's orbit (having passed through it on September 8), so that the fainter parts were projected behind the bright conoid, and near the extremity were directed almost straight away from the earth.

Comparison with Theory.

The theoretical axes of the tail are computed as follows: Assuming first $1-\mu = 1$, and taking the times of emission corresponding to the true anomalies

of the nucleus 100°, 125°, 140°, 150°, 160° and 165° we have for the epoch October 19.933

M = October 19.933 $\quad v = 170°\ 30'.5 \quad 1-\mu = 1$

v_1	M_1	ϕ	Δ	η	ξ
100°	Sept. 17.3276	+37°11′	4.9156	2.970	3.916
125	17.4664	+24 35	3.1611	1.315	2.874
140	17.7616	+16 53	2.0357	0.592	1.948
150	18.3884	+11 40	1.2762	0.258	1.250
160	20.8858	+ 7 29	0.4507	0.059	0.447
165	25.6810	+ 3 25	0.2096	0.012	0.209

These points, excepting the first, are represented on Plate X by the crosses on the line marked $1-\mu = 1.0$. This value of $1-\mu$ will satisfy the observations of the middle of the tail and the left extremity on October 19. The bright conoid requires a greater value of the repulsive force, and there are faint parts on the left side of the tail which indicate less values.

The points on the other axes, on Plate X, were computed with the accurate hyperbolic formulæ. I give the more important quantities:

$1-\mu$	v_1	M_1	log E	V_1	log P
2.6	140°	Sept. 17.7616	0.084428	+ 19° 18′ 54″	7.980462
2.6	150	18.3884	0.052266	16 5 5	7.980470
2.6	160	20.8858	0.025093	11 38 25	7.980482
2.0	140	17.7616	0.143433	27 30 56	8.184596
2.0	150	18.3884	0.093181	23 47 40	8.184585
2.0	160	20.8858	0.046926	17 52 40	8.184623
0.8	140	17.7616	0.507642	86 58 34	8.883555
0.8	150	18.3884	0.401694	97 31 21	8.883552
0.3	140	17.7616	0.054701	125 56 37	8.339488
0.3	150	18.3884	0.032986	138 32 39	8.339468

$1-\mu$	F	V	ϕ	Δ	η	ξ
2.6	89° 42′ 47″	+ 34° 25′ 6″	+19° 50′	3.8420	1.304	3.614
2.6	89 22 6	27 15 30	13 26	2.5318	0.588	2.462
2.6	87 51 42	18 35 46	6 55	1.1817	0.142	1.146
2.0	89 41 48	43 50 22	19 2	3.2393	1.056	3.062
2.0	89 21 50	35 49 56	12 56	2.1174	0.474	2.064
2.0	87 59 10	25 17 4	6 43	0.9602	0.112	0.954
0.8	89 27 12	107 34 54	16 34	1.6578	0.472	1.589
0.8	89 3 45	112 29 56	11 16	1.0770	0.210	1.056
0.3	87 31 35	150 39 10	13 41	0.8242	0.195	0.801
0.3	85 13 24	156 5 2	9 54	0.4798	0.082	0.473

The axis $1-\mu = 2.6$ passes through the middle line of the bright conoid, and the axes $1-\mu = 0.8$ and $1-\mu = 0.3$ fall within the limits of the faint part of the tail on October 19.

On September 18 and 25 the nucleus was situated near the apex of the head and the discharge seemed to take place from the sides. I have therefore taken for the right side of the tail $G = -90°$, and for the left $G = +90°$. As the initial velocity was probably greater than the average, while the comet was so near the sun, I have assumed $g = 0.1$. For the right side we have

$1-\mu$	M_1	G	g	log E	V_1	log P
2.6	Sept. 18.3884	$-90°$	0.1	0.061319	17° 13′ 27″	8.057553

and for the left

$1-\mu$	M_1	G	g	log E	V_1	log P
0.2	Sept. 17.7616	$+90°$	0.1	0.025244	134° 6′ 27″	8.234316

from which we obtain

$1-\mu$	F	V	ϕ	Δ	η	ξ
2.6	89° 21′ 32″	29° 25′ 8″	+11° 58′	2.5331	0.525	2.478
0.2	85 18 4	159 2 0	+16 48	0.5594	0.162	0.535

The lines drawn through these points include nearly all of the observed points which were within the limits of the tail. Those for the right extremity, October 4 and 10, were not accurately determined. The observation for January 29 was very uncertain, as the comet could scarcely be seen.

Comparing the observed with the computed points, we conclude that the bright conoid was composed of particles affected by the repulsive force $1-\mu = 2.0$ to 2.6. The particles at its extremity, October 19.933, were emitted from the nucleus about September 20.0. The faint part of the tail was composed of a number of conoids for which the value of $1-\mu$ ranged from 1.0 to 0.2 or less The particles at the extremity of these conoids, October 19.933, left the nucleus between September 17.76 and September 18.39. The line AC represents the ends of the various conoids which left the nucleus at the same time.

The tail attained its greatest length about November 7, at which time the extremity was more than twice as far away as the nucleus, and nearly one and a half times more distant than the head afterward was, when it became invisible to the eye.

Notes on the Head of Comet c, 1882.

September 18, 1h 15m. Sketch, Plate VIII, No. 1, *a*.

"As seen in the finder of the large equatorial. Clouds were flying rapidly all the time, making it difficult to keep the comet in sight. Comet was not seen in large telescope until nearly three o'clock, and then only the nucleus and part

of the coma were visible, on account of the brightness of the sunlight which entered the tube." [This sketch is not drawn to scale.]

September 18, 17h 47m. Sketch, Plate VIII, No. 1.

"Power 90. Length of branches ½ diameter of field. Sun just up. In the finder length equal ¼ diameter of field. 17h 53m.—P. A. of axis of tail 270°.6. P. A. of left side of bright fan 331°.6; right side 213°.9. Width of head at nucleus 54″.6.

"Power 230. Nucleus still visible and large, with two wings. The sky is quite hazy in addition to the bright sunlight."

September 24, 17h 25m. Sketch, Plate VIII, No. 2.

"Power 90. Nucleus seems brightest on side opposite sun. With nucleus at edge of field, P. A. of the intersection of left branch with opposite edge of field 249°; right branch 280°. Nucleus in center of field: P. A. of inner edge of right branch, at nucleus, 303°.3; ditto of left branch 231°.6. These measures were taken as the comet's head appeared through rifts in the clouds near the horizon. 17h 47m.—Comet's head still visible to naked eye through thin clouds. At sunrise; nucleus visible with power 90; scarcely visible in finder." [The engraving does not show the nucleus satisfactorily. In the original sketch the nucleus is very large, distinct and round. The nebulosity between it and the sun is not more than half the diameter of the nucleus in depth. I will state here also that none of the engravings on Plate *VIII* show the nucleus, or nuclei, as distinctly as they were actually seen.]

October 4, 17h 12m. Sketch, Plate VIII, No. 3.

"P. A. of nuclei 277°.0 [two measures]. There is no fan. There is one jet on the upper side of the larger nucleus, but it is so short, narrow and condensed that it seems like a third nucleus, only that there is no separation between it and the larger one. The smaller nucleus has a longer jet in the direction of the tail and quite bright. The coma is comparatively faint. By that I mean that there is no bright envelope around the nucleus. It is very little brighter than the tail near the head. 17h 40m.—[Sketch *a*.] Nothing is now visible in power 90 but the two nuclei and part of the appendage to the smaller one. The clear space between the nuclei I estimate at 2″, the distance between their centers 10″. The micrometer wire being broken, I can make no measures."

October 5, 17h 29m. Sketch, Plate VIII, No. 4.

"Head not very plain at first on account of clouds. At 16h 30m it became plainly visible with power 90. Nucleus is still divided into three parts.

16h 50m.—P. A. of upper nucleus [n_3] 277°.4, distance 6″.26
" " lower " [n_1] 278.6, " 5.60

"17h29m.—Power A. Two lower nuclei, n_1 and n_2, are distinctly visible. The upper, n_3, is blurred almost out of sight. P. A. $n_2 n_1$, 280°.2; distance 5″.40 [two measures, each a quadruple distance]. n_2 estimated 3″ in diameter; n_1 estimated 1″.5; n_3 blurred. n_1 has an appendage in P. A. 280°.4, length estimated

30″. A small fan emitted from n_3 toward the sun. The two nuclei n_1 and n_2 are round and planet-like; appear solid. $17^h\ 40^m$.—n_1 and n_2 are still visible, although through thick clouds. $17^h\ 45^m$.—No longer visible. During last measures the appearance was like this [Sketch *a*]. Scarcely any of the nebulosity could be seen."

October 6, 17h 36m. Sketch, Plate VIII, No. 5.

"Power 90. Tried power *A*. Comet too faint and blurry. P. A. of nuclei 281°.9. There seem to be four nuclei in a row. $17^h\ 44^m$.—Distance between two central nuclei [$n_1 n_2$] 7″.58. Too faint in daylight. Nothing visible except two little round discs."

October 12, 17h. Sketch, Plate VIII, No. 6. [No Notes]. **17h 39m.** Sketch *a*.

"As visible now. P. A. of nuclei 285°.2. At first the nebulosity was so thick and bright around the nucleus that I could not distinguish the separate portions, but it appeared about four times as long as broad. As the sky became lighter the nebulosity faded out of sight, and the three separate parts of the nucleus became distinctly visible. The appearance and relative positions are about the same as on the 6th. The third is a mere point, apparently within the fan or jet emitted by the second or principal nucleus. The first has a small round disc with an appendage approximately in the direction of the tail. Whether this appendage is a jet or not I am unable to satisfy myself."

October 13, 16h 20m. Sketch, Plate VIII, No. 7.

"The nuclei seem more distinctly visible and better defined than yesterday. The nebulosity around them is not so dense. P. A. of the three nuclei 285°.2. P. A. of the appendage to n_1 288°.1. The central part of the tail is not dark, but brighter than the outer portions. Sometimes I think I can see two bright points in the appendage to n_1 near the preceding end. The nebulosity is dense on the right side of the nuclei.

$16^h\ 41^m$.	Distance n_1 to bright point near end	16″.11
	" $n_1\ n_2$	8.35
	" $n_2\ n_3$	9.83."

October 19, 17h 0m. Sketch, Plate VIII, No. 8.

"$16^h\ 15^m$.—Power 90. Envelope faint. Nucleus bright, but very hazy, so that division is scarcely visible. Can barely see n_1 and n_2, but n_3 is not yet distinct. $16^h\ 20^m$.—Power A. Nucleus very elongated, about 60″ by 10″, but can not see any separation. $16^h\ 30^m$.—Separation is becoming more distinct now. Can see n_1 and n_2. P. A. of the whole elongation 290°.4. $16^h\ 38^m$.—Power 90. n_1 and n_2 are quite distinctly visible and separated. n_3 is faint and hazy yet. P. A. of the three nuclei 286°.6. The P. A. above included the appendage to n_1. P. A. of the latter 293°.7.

$16^h\ 50^m$	Distance $n_1\ n_2$	10″.03
16 53	" $n_2\ n_3$	9.01
	" $n_1\ n_0$	29.6
	P. A. of bright axis of tail	274°.8

$17^h\ 49^m$.—n_1 and n_2 still visible with power 90."

October 20.

"n_1 and n_2 very plainly visible. n_3 indistinct. Think I can see one or two bright points in the tail of n_1. Is not this made up of large meteors? P. A. of n_2n_1 286°.6. P. A. of tail of n_1 290°.9. $17^h\ 23^m$.—P. A. of n_2n_3 290°.6. $17^h\ 30^m$.—Distance n_2n_1 10″.20. n_3 too faint to measure."

October 29. Sketch, Plate VIII, No. 9.

"$15^h\ 30^m$.—Nucleus quite bright and very much elongated in the direction of the tail. Can not distinguish the separation with power 90.

"$15^h\ 50^m$.—With power *A* nucleus is five times as long as broad, but no distinct bright discs are visible. $16^h\ 40^m$.—Two nuclei can now be distinguished, n_1 and n_2. They are farther apart than hitherto, but not distinct enough to measure distance. P. A. of nuclei 293°.2. With power *A* the bright parts of the nucleus are much more nebulous and indistinct. There seem, however, to be two bright points within them. Axis of tail 281°.4. [Sketch]. $17^h\ 40^m$.—Nuclei are now sufficiently distinct for measures of distance. Distance n_1n_2 15″.84. With power *A* nuclei could be seen, but not so distinctly as with power *I*."

November 2. Sketch, Plate VIII, No. 10.

"$16^h\ 50^m$.—Nucleus very much elongated,—5 : 1. Can see two bright portions (n_1n_2), but not distinctly separated. $17^h\ 55^m$.—P. A. of nuclei 295°.2 [two measures]. Distance 15″.90. Not good. Too faint to measure. No jets were visible. At first the nucleus was very much elongated and surrounded by a thick hazy envelope, not very extensive, however. The tail was brightest just behind the nucleus where the dark space was during the earlier observations. By moving the telescope back and forth I could discern the outline of the head to consist of two curves issuing from the nucleus. These curves were not visible without motion of the telescope. [Sketch.] I could see two portions of the nucleus which were brighter than the rest, and afterward thought I could see two others. The two brighter ones were between the others. The sky was somewhat hazy, which I think was the reason I could not measure the distance of the nuclei."

November 3. Sketch, Plate VIII, No. 11.

"$17^h\ 6^m$.—P. A. of nuclei n_2n_1 294°.7. P. A. of bright axis of tail 281°.2. Distance of nuclei n_2n_1 21″.06. The two bright round spots, n_1 and n_2, within the nucleus were visible, and a third seemed to appear, now and then, at the end of the nucleus nearest the sun. The nucleus was surrounded by a hazy envelope, nearly round, a little elongated with the nucleus. A bright streak extended from behind the nucleus through the tail. The outline of the fainter part of the head was as yesterday, two curves issuing from the end of the nucleus. These could be distinguished only by moving the telescope back and forth in the direction of the tail."

November 7. Sketch, Plate VIII, No. 12.

"$16^h\ 30^m$.—P. A. of bright axis of tail 285°.9. Elongation of nucleus 303°.3. Width of bright nebulosity around the nucleus 67″.0; length 138″.2. Distance of the two bright points n_1 and n_2 19″.15. $16^h\ 42^m$."

November 20.

"Could not see the division in the nucleus, but could see a brighter portion at the following end, which I used as the point of measurement. The nucleus was elongated as usual. P. A. estimated roughly from memory, 315°. In the transits I took also the time of the preceding end of the nucleus. The whole appearance of the head was nearly the same as when I saw it last, except that I could not see the two bright points in the nucleus. $18^h\ 15^m$."

November 29.

"At first it was very clear and I could see the two brighter portions of the nucleus, but could not distinguish their discs. Nucleus elongated as usual. Clouds did not give me time to measure position angle."

December 11.

"Too cloudy. Can not see the comet with faint illumination."

January 29, 1883.

"With power 90 scarcely any tail at all is visible. The nucleus is elongated in the direction of the tail and is large and indistinct. Clouded up before I could take measures of position."

January 31.

"With power 90 tail can not be traced more than one diameter of field. Coma elongated and slightly condensed in central part. P. A. 51°.1. P. A. of tail is a few degrees less than this. Too faint to measure."

February 8.

"$9^h\ 3^m$.—P. A. of elongation of nucleus 70°.2. P. A. of tail 57°.0. Width of bright part of coma 61″.0; length, 172″.7. Nucleus is on the lower side of the visible part of the tail. Nucleus large and indistinct."

February 28.

"Comet very faint. Elongated in P. A. 69°.2. Tail can be traced 1½ diameters of field, power 90."

March 2.

"The head is elongated still in about the direction of the tail, which is scarcely visible. P. A. of elongation 253°.0, approximately." [A sketch accompanying this note shows that the appearance of the head was similar to the brighter part as sketched November 7th, only very much fainter.]

DISCUSSION OF THE NOTES.

Comparing the sketches on Plate *VIII* with those on Plate *VII*, it seems probable that, from September 18 to October 12, I saw only the head of the bright conoid and that, from October 13 to November 7, the head of the fainter part of the comet was also visible in the telescope. Figure 2, Plate *X*, gives the outlines of the parts of the head and nucleus October 19. The first observations were made in the sunlight or bright twilight, so that only the sides of the conoid, where the depth of matter seen through was greatest, were visible. As the comet moved away from the sun and out of the twilight, the sides of the conoid gradually contracted and more of the matter could be seen toward the middle, thus apparently filling in the dark hollow space, so that after October 12 it was no longer visible.

This comet, although so brilliant to the eye, was by no means so fine an object in the telescope as the great comet of 1881. There were no bright jets or envelopes such as were seen in the latter. My attention was drawn chiefly to the nucleus, which, between September 24 and October 4, seems to have met with a catastrophe, by which it was separated into three or more parts. Two of these, designated n_1 and n_2 in the notes, had perceptible discs and were "round and planet-like." Their diameters, if the estimates made with power 450 on October 5 were correct, were $n_1 = 900$ miles and $n_2 = 1800$ miles. These discs were seen best in the bright twilight after the nebulosity around them had become invisible. They were seen distinctly October 4, 5, 6, 12 and 13. Bright points corresponding to n_1 and n_2 were visible up to November 29. The one point of condensation January 31 was probably n_2.

The third nucleus n_3 appears to have been seen with certainty from October 4 to October 20, but was at all times very minute and surrounded with a hazy envelope.

n_1 with its appendage resembled very much the secondary nucleus and jet observed in Comet *b*, 1881, on July 6, but was certainly of a more permanent character. The appendage was seen distinctly up to November 7, and indistinctly, in the general elongation of the nucleus, up to the last observation. Its position angle, as measured from October 5 to October 20, was about 3° greater than that of the nuclei $n_2 n_1$. A fourth bright point was at times seen within this appendage.

The principal measures given in the notes are those of the nuclei and the axis of the tail. The reductions of the position angles and distances are given in the following tables:

Axis of Tail.

Greenwich M. T.		p	p_0	$p - p_0$	s	ϕ	Δ
September	18.978	270°.6	260°.1	+10°.5	9′	+28°.3	...
	24.962	267.5	261.5	+ 6.0	9	+17.1	...
	24.962	264.9	...	+ 3.2	18	+10.6	...
October	19.937	274.8	271.1	+ 3.7	18	+ 5.7	...
	29.930	281.4	275.4	+ 6.0	18	+ 6.4	...
November	3.947	281.2	278.8	+ 2.4	18	+ 2.7	...

Greenwich M. T.		p	p_0	$p-p_0$	s	ϕ	Δ
November	7.926	285°.9	281°.3	+ 4°.6	18′	+ 4°.6	...
January	31.603	<50	49.6	0	18	0	...
February	8.602	57.0	59.8	— 2.8	18	— 1.9	...
			n_2 n_1				
October	4.951	277°.0	264°.9	+12°.1	est 10″	+20°.5	...
	5.951	279.4	265.3	+14.1	5.50	+21.9	0.000082
	6.971	281.9	265.7	+16.2	7.58	+23.4	0.000120
	12.971	285.2	268.1	+17.1	...	+21.6	...
	13.923	285.2	268.4	+16.8	8.35	+21.0	0.000130
	19.937	286.6	271.1	+15.5	10.03	+17.8	0.000150
	20.964	286.6	271.5	+15.1	10.20	+17.2	0.000151
	29.930	293.2	275.4	+17.8	15.84	+16.3	0.000248
November	2.981	295.2	278.2	+17.0	15.90	+15.1	0.000233
	3.947	294.7	278.8	+15.9	21.06	+14.1	0.000317
	7.926	303.3	281.3	+22.0	19.15	+16.8	0.000320
			n_3 n_2				
October	4.951	277°.0	264°.9	+12°.1	...	+20°.5	...
	5.937	277.4	265.3	+12.1	6.26	+20.0	0.000088
	6.971	281.9	265.7	+16.2	...	+23.4	...
	12.971	285.2	268.1	+17.1	...	+21.6	...
	13.923	285.2	268.4	+16.8	9.83	+21.0	0.000154
	19.937	286.6	271.1	+15.5	9.01	+17.8	0.000135
	20.964	290.6	271.5	+19.1	...	+20.2	...
			n_1 n_0				
October	5.937	280°.4	265°.3	+15°.1	est 30″	+22°.9	...
	6.971	281.9	265.7	+16.2	...	+23.4	...
	12.971	285.2	268.1	+17.1	...	+21.6	...
	13.923	288.1	268.5	+19.6	16.1	+23.0	0.000267
	19.937	293.7	271.1	+22.6	29.6	+22.7	0.000507
	20.964	290.9	271.5	+19.4	...	+20.4	...

Elongation of Whole Nucleus.

		p	p_0	$p-p_0$	ϕ	Ratio of length to width.
October	4.951	270°.0	264°.9	+12°.1	+20°.4	...
	5.937	280.0	265.3	+14.7	+22.5	...
	6.971	281.9	265.7	+16.2	+23.4	4 : 1
	12.971	285.2	268.1	+17.1	+21.6	4 : 1
	13.923	286.7	268.5	+18.2	+22.0	...
	19.937	290.4	271.1	+19.3	+20.6	6 : 1
	20.964	289.4	271.5	+17.9	+19.3	...
	29.930	293.2	275.4	+17.8	+16.3	5 : 1

		p	p_0	$p-p_0$	ϕ	Ratio of length to width.
November	2.981	295°.2	278°.2	+17°.0	+15°.1	5 : 1
	3.947	294.7	278.8	+15.9	+14.3	...
	7.926	303.3	281.3	+22.0	+16.8	138″: 67″
	20.995	315	291.3	+24	+15	...
January	31.603	51.0	49.6	+ 1.4	+ 0.8	...
February	8.602	70.2	59.8	+10.4	+14.0	173″: 71″
	28.631	69.2	78.0	— 8.8	—11.6	...
March	2.613	72.9	79.4	— 6.5	—12.2	2 : 1

The deviation of the axis from the radius vector was very marked in September, but the angle ϕ derived from the position angles then observed are uncertain, for the earth was then very near the plane of the comet's orbit, so that a small error in p would produce a large error in ϕ. The position angles observed after November 7 were also liable to error from the faintness of the comet as seen in the telescope.

The ϕ and Δ of the parts of the nucleus were computed on the assumption that the center of each part was in the plane of the orbit. The change of signs in February, before the earth had again reached the plane of the comet's orbit, would seem to indicate that the elongation was not in the plane of the orbit. The last four observations are however not very reliable, as the comet was then exceedingly faint.

For the whole elongation $p-p_0$ shows a gradual increase from October 4 to 19, and a decrease from October 19 to March 2, while ϕ decreases for the whole time.

For n_2n_1, $p-p_0$ shows an increase to October 12, a decrease to October 20, and an increase to November 7, while ϕ shows a general decrease.

For n_3n_2 and n_1n_0 the change in $p-p_0$ October 4 to 20 is about the same as for the total elongation, and ϕ is nearly constant.

The distance of the discs n_1 and n_2 increased regularly from 5″.5 October 5, to 19″ November 7, or, in linear measure reduced to the plane of the orbit, from 0.000082 to 0.000320 astronomical units,— 7,500 miles to 29,500 miles.

The distance of n_3 from n_2 seems to have increased at about the same rate.

If we plot the Δ,s n_1n_2, we find that they may be represented fairly by a straight line drawn from the first to the last. This line extended backward crosses the zero line at about September 20, which is the date already found for the emission of the bright conoid of the tail. This coincidence is remarkable, for it suggests the inference, that the division of the nucleus and the emission of the bright conoid occurred at the same time, and were the result of the same cause.

From the differences in the times of transit of the parts of the nucleus we may also determine their distances by the formula $s = da \cos \delta \operatorname{cosec} p$.

The following table gives the results obtained in this manner:

	da			Number	$s = da \cos\delta \operatorname{cosec} p.$		
	n_0n_2	n_1n_2	n_2n_3	of Transits.	n_0n_2	n_1n_2	n_2n_3
	s	s	s		$''$	$''$	$''$
October 4	...	0.40	...	9	...	6.0	...
5	...	0.42	0.42	6	...	6.3	6.3
6	1.17	0.54	0.36	10	17.7	8.2	5.4
13	1.64	0.49	0.45	6	24.6	7.4	6.8
19	...	0.53	...	6	...	8.0	...
20	...	0.53	...	8	...	8.0	...
29	...	0.85	...	14	...	13.0	...
November 2	3.21	0.89	0.79	20	50.0	13.8	12.2
3	3.85	0.92	0.81	10	59.6	14.2	12.5
7	3.96	1.05	...	10	65.9	17.4	...
20	3.86	...	...	6	73.4	...	...

These distances show about the same rate of increase as the direct measures. It is singular, however, that, with the exception of the first three of n_1n_2, they are all less than the direct measures by about the same amount.

Notes on Comet d, 1882.

September 25.6.

"Comet is very faint. Requires very little illumination. No perceptible tail. There is a bright point in the center, but very small, which was observed as the nucleus."

October 11.6.

"Comet very faint in haze near horizon. Slight central condensation. No tail."

October 12.6.

"Comet strongly condensed in center. No sign of tail."

October 13.6.

"There is a faint star on the south side of the comet which might be mistaken for the nucleus. No sign of tail yet."

ERRATA.

On Plates *I* and *II* the scale should be ° instead of ′.

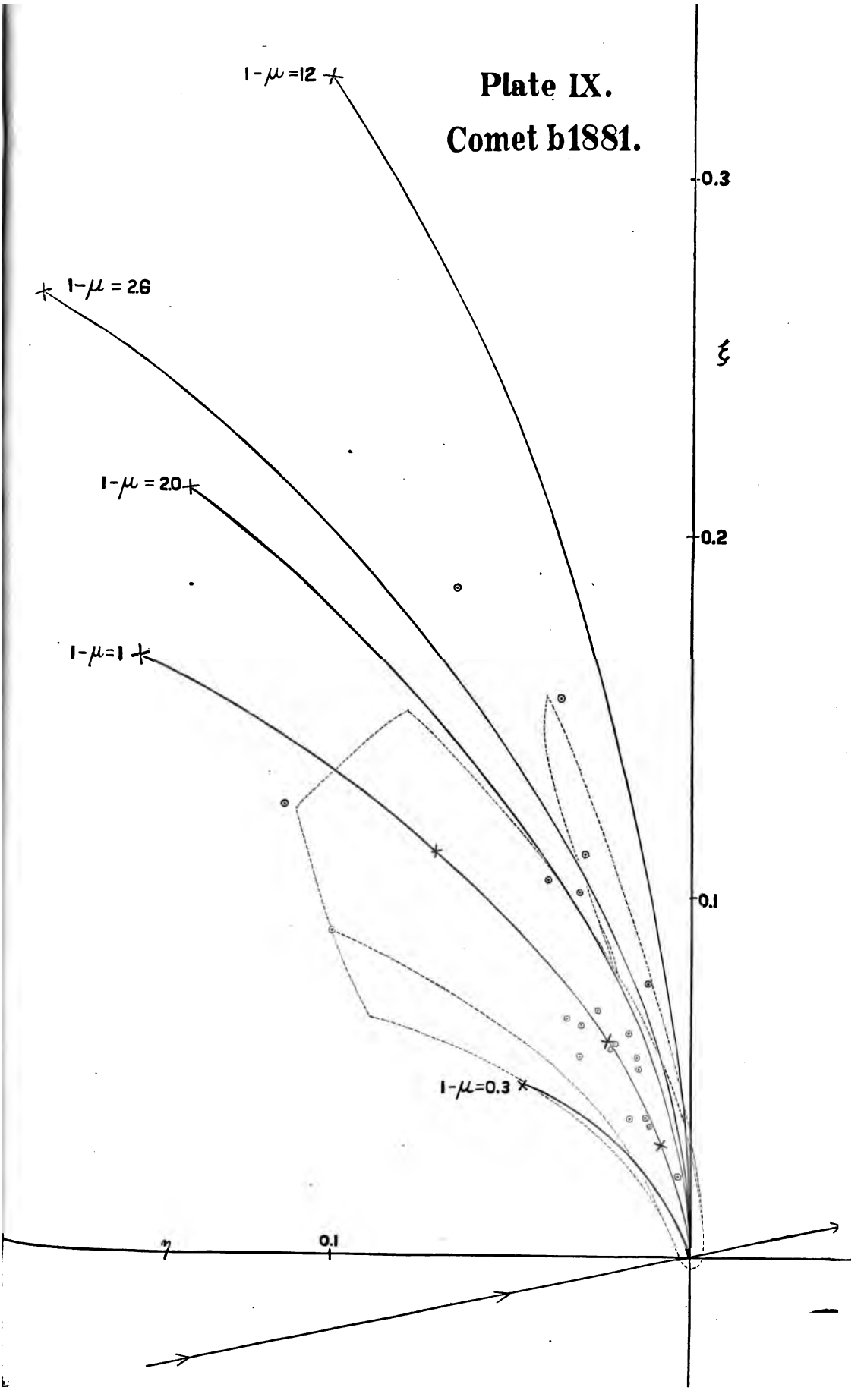
Plate IX.
Comet b1881.
1-μ=12
1-μ = 2.6
1-μ = 2.0
1-μ=1
1-μ=0.3
0.3
0.2
0.1
ξ
η
0.1

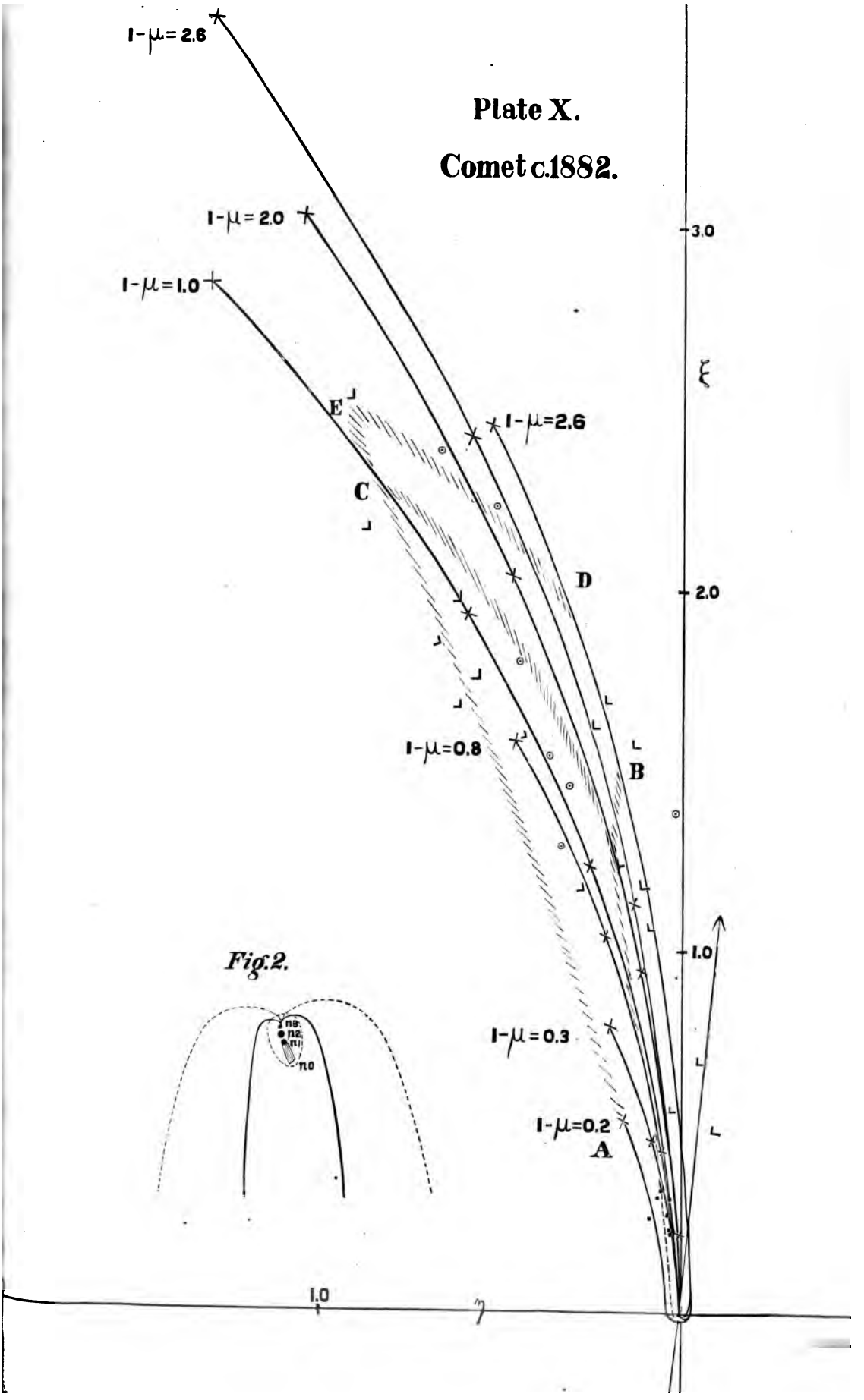
Plate X.
Comet c.1882.
1-μ=2.6
1-μ=2.0
1-μ=1.0
E
C
D
B
A
1-μ=2.6
1-μ=0.8
1-μ=0.3
1-μ=0.2
3.0
2.0
1.0
ξ
1.0
η
Fig.2.
n3
n2
n1
n0